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The Electrical Industry

THANKS to a variety of causes the electrical industry of this country is at present enjoying a period of great prosperity. There can be few concerns engaged in electrical and allied manufacturing which are not doing well to-day; this is an extremely happy state of things which has seldom, if ever, occurred before.

There have been times when particular sections have slumped and suffered from severe internal and external competition, while others have enjoyed prosperity; producing companies operating both of these classes of business have set the losses of one class against the profits of the other. There is little evidence that this state of affairs exists in 1937.

It is a mistake, however, to credit financial results of 1936-7 to the Government defence operations, for as Lord Hirst stated in his speech to his shareholders last week, we are enjoying a wave of prosperity, upon the top of which he thinks we can safely reckon to ride for a few years to come, due to other influences beside defence measures. He attributes present activity to the definite Government policies of protection, cheaper money, house building programmes, and the Ottawa Agreements, followed of course by the defence measures which are now making large demands on electrical and allied factories, and will continue to do so.

So far as his own company is concerned, Lord Hirst said that the armament programme had not played an appreciable part in the activities of the year covered in the report recently published; its engineering works activity was mainly due to the requirements of industry as a whole. It is a platitude that electricity is increasingly essential in every department of industry. Who cannot recall the years when want of industrial and railway electrification work formed a dark cloud over heavy sections of the industry?

For several years to come the defence expenditure will have a beneficial effect both from new commitments and from larger maintenance liabilities, but, apart from this, we think that Lord Hirst is justified in looking forward optimistically when regard is paid to the wide range of products for developing electrical applications and tendencies, and to the sound and consistent way in which his company has advanced from year to year.

Recent achievements have not been due to spectacular work, but they have followed because when the foundations of the company were laid years ago a policy of research and development on the production side and keen salesmanship and efficient service on the commercial side was adopted, a policy which has been subsequently adhered to.

A point which may sometimes be lost sight of is the continuing effect of the very large contracts which are so much more general to-day than they used to be. This is particularly the case in connection with heavy engineering, electric railway equipment work, cable-making and laying, and so forth; such orders sometimes take more than a year to complete, and companies who have such operations in hand, and have the strength to carry them, may show the financial result in the following year. Against this hopeful prospect we have to remember that demands for increased wages and perhaps further advances in raw material costs may have to be faced, "anyhow for a time."

As has been stressed frequently of late, the export trade section of the electrical industry must not be allowed to suffer while we are so full of business. We must not reduce our efforts to strengthen our hold on overseas markets, and we should not overlook the fact that a very large percentage of our exports is finding its way to British territories, where buyers expect to receive personal visits from responsible heads of our manufacturing concerns.

The Distribution Proposals

MANY voices have been raised for and against what are described as the Government proposals regarding the future of electrical distribution. If fewer of them are being heard in public there is unquestionably a good deal going on behind the scenes. A few weeks ago there was so much irritation and outcry from most of the parties whose undertakings were likely to be affected, consequent upon the issuance of an unexpectedly elaborate schedule which was not forecast in the Parliamentary references by the retiring Minister of Transport, that it seemed that the "Scrap the Lot!" critics might succeed. Though the new Minister of Transport denied that the Government had arrived at a decision to do any such thing, he certainly seemed to be wavering before the storm of opposition of one kind and another.

What Kind of Commissioners?

THE latest impression one can gain is that conveyed in a leading article in *The Times* of July 1st, which remarked that "he wisely made it clear that the Government were not wedded to every detail of the draft proposals." The Government could certainly not be so wedded, seeing that the "draft proposals" had been submitted to representative organisations of those directly interested for their views. Those views, presumably, are now before the Commissioners or the Minister of Transport, or both, and a little later some draft legislation may be submitted to members of the House of Commons. One of the chief weaknesses of the position was the suggested replacement of the McGowan District Commissioners by the Commissioners themselves. As *The Times* remarks, whatever fears this change may have caused, "it seems a pity to depart from the Report without better reason than is given in the Government proposals." The alteration was not easy to understand seeing that Sir John Snell, who was the chief electrical member of the McGowan Committee, was, and still is, the chairman of the Electricity Commission. *The Times* article has produced a crop of letters from correspondents, who look at the subject from their own particular standpoints.

The Political Aspect

IT was inevitable that the proposals would form the subject of political controversy, for all parties have for years past made their objectives more or less plain to the electorate. It may happen that this Government will have to reach a decision on whether electricity supply is a fit utility for nationalisation, socialisation, ultimate national ownership or control, fifty years hence or earlier, or not at all, but whether that be actually the line along which Parliamentary policy will be fought out, those in authority at Westminster cannot evade the desirability of distribution reorganisation. What is perhaps as obvious as anything well can be is that the electrical industry is in no mood for dictatorship control. It doesn't like legislation; it has had enough of it, but if there is to be such, the industry wants to see a "fair deal all round," and the sooner there is evidence that that will be assured the better it will be. It will dispense with much of the pettifogging discussion that is taking place in some parts of the country where, say, for example, local authorities who have never exercised any electricity powers are wanting to take over bits of power company areas where excellent and cheap service has for years past been given to consumers. Some writers assume to themselves the right to speak for all consumers of electricity; of course, nobody has such a right, nor is it seriously believed that the need for reorganisation is because consumers are up in arms. They are nothing of the kind—we are adding hundreds of thousands of satisfied consumers every year. We, of course, do not advocate resting content with things as they are, but we do want to see this matter so handled that when it comes before Parliament for settlement there will be no confusion in the minds of legislators. Electrical members in both Houses have an opportunity of so discussing the matter that there shall be no mistake made this time.

The Smaller Undertakings

THE Committee of Smaller Municipal Undertakings has issued its counter-proposals to those outlined in the Memorandum. The Committee proposes that the Electricity Commissioners shall appoint committees to report upon various aspects of the distribution question and then set up district authorities with compulsory powers after a trial period of five years. It is considered that the suggested procedure would accelerate the rate of electrical development to a greater degree than the official propositions. No doubt contributions such as this will help members of the Legislature to come to closer grips with the subject than much correspondence in the Press.

Too Much Flex

FLEX is a useful means of enabling appliances to be used within a wide radius, but there are two dangers—one is that the radius is likely to be too extended, and the other that the flex will be of an inferior quality. In both cases there is a serious risk of shock or fire. Therefore, the "extended" use of flex should be discouraged and more plug points should be installed to eliminate the necessity of more than a reasonable length. These thoughts are prompted by a cutting from a Sunday paper sent us by a reader, which runs as follows:—

> "Bring your standard or table lamps on to the verandah or in the garden these warm summer evenings when it gets too dark to read or sew. Simply lengthen the flex."

Our correspondent asks: "Isn't it awful?" and we are forced to agree.

Ice Making

ALTHOUGH not within the compass of the E.D.A. refrigeration campaign, the starting up of a large commercial installation, such as that of the North Shields Ice Co., described in this issue, will no doubt help towards creating the desired "atmosphere." This factory represent an important addition to the national resources in this connection, there being, we believe, only four others comparable in Great Britain. Moreover, situated near the coalfields, it attracts foreign vessels to the port for the dual purpose of obtaining fuel and ice. Load of this character is attractive to the supply undertaking, as it reaches its height in the summer and can be reduced during the winter peak without difficulty. Mr. W. E. Walker, the Ice Co.'s manager, considers that electrical methods surpass all others he has known in his forty-six years' experience in economy, cleanliness, ease of control, reliability, adaptability to requirements and grouping to best advantage. The design and layout of the plant clearly owes much to co-operation between electrical and refrigeration engineers.

Clean Steel

THE essential part played by the electric furnace in the production of steels of high alloy content is well recognised, but the merits of the electrical method are by no means confined to this field. Structural steels of ordinary composition might, seemingly, be just as well made by the open-hearth process. Messrs. Samuel Fox & Co., however, do not hold this view, and are installing another 5-ton high-frequency furnace at their Stockbridge works, near Sheffield. As a result of their experience they have found that an enormous advantage is to be obtained from the closer control of steel making rendered possible by the use of the electric furnace. The reason is that the structural steel thus produced has the homogeneous character and the clean and regular quality required in so many directions in modern engineering practice, (*e.g.*, for aeronautical and automobile work), where heavy stresses and low factors of safety assume importance.

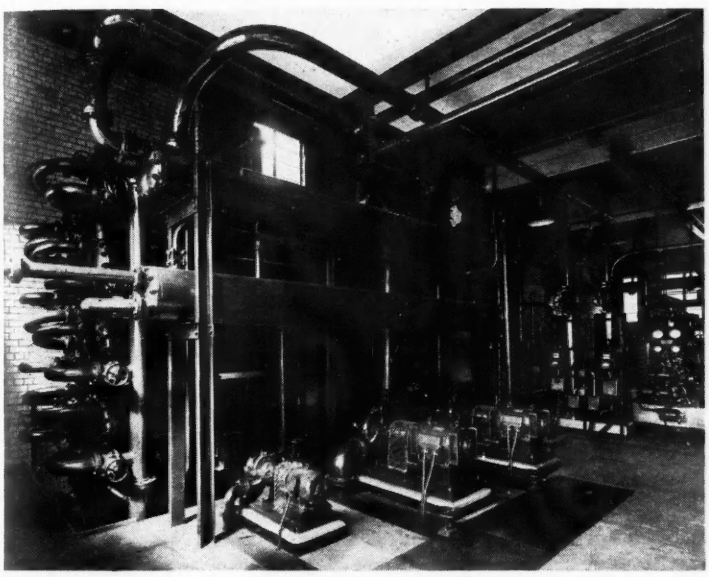
A Large New Ice Factory

FOR about forty years now the supply of ice to the trawlers of the home fleet based on North Shields, as well as to the many foreign vessels calling there, has been largely provided by the two original factories of the North Shields Ice and Cold Storage Co., Ltd. These were superseded in May last by the modern electrified factory which was then opened.

The North Shields ice and cold-storage works

The new building, costing £31,000 to erect, together with its site covering 1,450 sq. yd., is the property of Tynemouth Corporation, and is rented by the North Shields Ice Co., which has spent approximately the same amount on plant for the manufacture of ice and the preservation of food in cold storage. An important feature of this factory is that its situation on the quayside and its up-to-date electrical installation enable ice to be loaded directly from the freezing plant into the ships' holds at the rate of 60 tons per hour.

The building, which comprises three floors and measures 180 ft. by 72 ft., has a steel framework with pre-cast concrete floors and roofing and cavity outside walls. The amount of direct sunlight penetrating the main ice deck has been limited to the minimum adequate for the purpose, but for the offices (which accommodate also the clerical department of the neighbouring Tyne Brand Products, an associated concern) the opposite effect has been obtained by the construction of a roof lantern capping an interior lighting well and by large continuous windows separated by slender steel frames. Artificial lighting is provided by "Benjamin" fittings of pleasing design and heating is by air, which is passed through a "Visco" filter before being warmed by steam coils.



Compressor and controls for cold-storage installation (12-point distant thermometer on left)

The contract for the supply and erection of the refrigerating plant was carried out by L. Sterne & Co., Ltd., whilst the electrical equipment, including motors, switchgear and cables, was supplied by Bruce Peebles & Co., Ltd. The whole of the work was carried out to the specification and under the personal supervision of Mr. W. E. Walker, manager of the Ice Co., and Mr. H. Clow, assistant manager, to whom our thanks are due for facilities provided on our recent visit.

The main supply for power is taken from the 5.5-kV system of the Tynemouth Corporation at a static sub-station situated at one end of the compressor room, where it is transformed to 440 V and fed to a three-panel metal-clad switchboard of Switchgear & Cowans' make. The circuit-breakers are of the totally enclosed draw-out type with a rupturing capacity of 150,000 kVA. The two controlling the main compressor motors are electrically interlocked with the rotor starters. The third panel controls all the other circuits, and switching arrangements are designed to meet the conditions of the tariff of the undertaking and the requirements of Lloyd's.

The tariff under a ten-year agreement includes a service charge of £100 per annum, a demand charge of £1 10s. per kW per annum and a running charge of 0.5d. per kWh for the first 400,000 kWh per annum and 0.4d. for each additional kWh. The maximum demand is measured only between 10 a.m. and 9 p.m. during the five months October to February, but between 3 p.m. and 9 p.m. it must not exceed 25 h.p. This enables a smaller compressor, used for maintaining the correct temperatures in the cold-storage chambers, as stipulated by Lloyd's, to be run continuously. Warning is given by buzzer of the approach of the "cut-off" period, failure to observe which results in the switches being tripped automatically—a necesssary precaution, since the penalty for exceeding the agreed demand within this period is £4 per kW per annum. Should the high-voltage supply fail, up to 60 h.p. can be taken from the low-voltage network to keep going cranes, conveyors, and crushers as well as the cold-storage compressor.

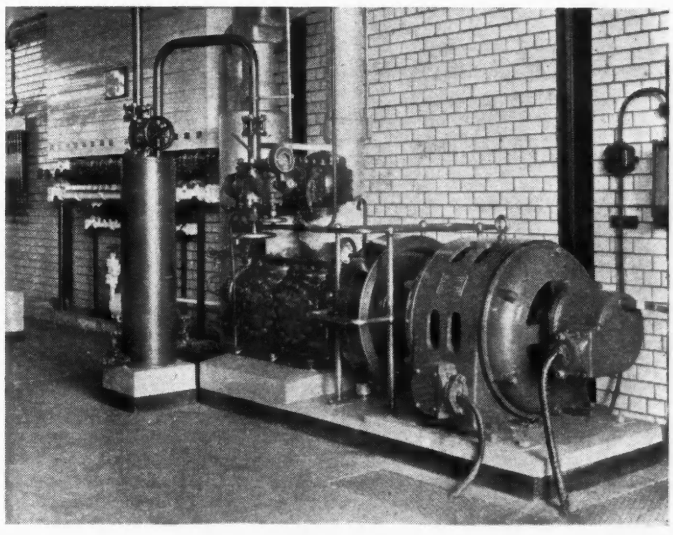
Condensers and pumps with one of the main compressors in background

The consumption of the present installation, it is estimated, will be approximately one million kWh per annum. The maximum demand to date has been 280 kW, but may be as much as 550 kW under summer conditions.

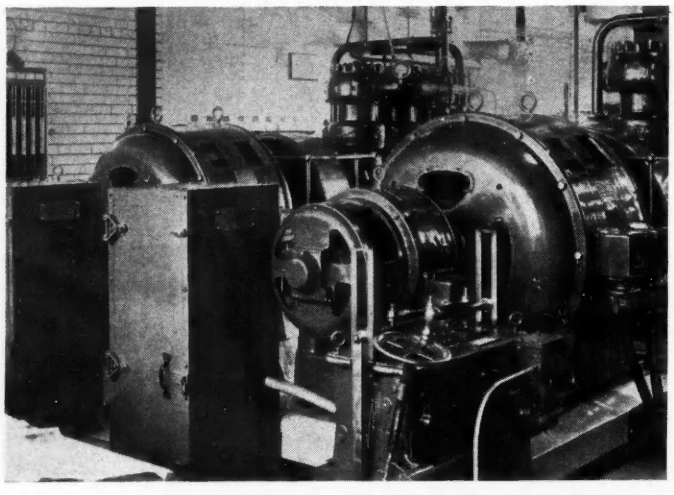
Distribution is through paper-insulated lead-covered s.w.a. cables, those between the transformer and the main switchboard being supported on porcelain insulators in a trench, others being carried overhead and secured to girders. The cabling was carried out by Campbell and Isherwood, Ltd.

The Compressor Room

The factory is divided into three sections, *viz.*, the compressor room, the tank room and the cold-storage chambers.



The compressor room, which is situated on the ground floor, contains three totally enclosed vertical ammonia compressors. Two of these are capable of manufacturing 80 tons of ice per day each. They are direct-coupled to 175-h.p. 375-r.p.m. protected synchronous-induction motors which are started up as



Motors driving main compressors

slip-ring machines by means of moving electrode liquid starters with slow-motion operating gear made by Allen West and Co., who also supplied the hand-operated air-break switches installed for driving the other Bruce Peebles motors about the works.

The exciters, on the same shaft, supply the field current necessary to produce unity power factor at full load and at lighter loads (*e.g.*, when the temperature of the condensing water is low) the value may reach 0.7 leading, which not only compensates for the other motors on the premises but also exercises a beneficial effect on the regulation of the undertaking's network.

In the event of the delivery pressure of the compressor exceeding approximately 200 lb. per sq. in. (the normal maximum being 150 lb. per sq. in.) due, for instance, to failure of the condensing-water service or incorrect starting up, a device on the set causes the no-volt coil on the main switch to operate and cut off the supply.

For condensing the ammonia dealt with by the main compressors, eight horizontal shell and tube condensers are arranged in two stacks. Each condenser is provided with its own hot-gas inlet, liquid outlet and water in-and-out connections, all fitted with stop valves, so that any one can be isolated for cleaning without interfering with the running of the plant. The liquid headers drain into a tank below the condensers.

Cooling water is drawn from the River Tyne at a temperature that seldom runs above 62 deg. F., and is circulated by two " Pulsometer " centrifugal pumps driven by 21-h.p., 1,455-r.p.m. screen-protected squirrel-cage motors, either one of which is capable of full duty. Provision has been made for the installation of a third 175-h.p. compressor unit.

For maintaining the desired temperature in the cold-storage chambers on the ammonia direct-expansion system a smaller compressor of the same type driven by a 42-h.p. 415 r.p.m. slip-ring induction motor has been installed complete with its own condenser and water pump. Stand-by to this set is provided by cross-connecting the cold chambers on the ammonia and water sides with the main ice plant.

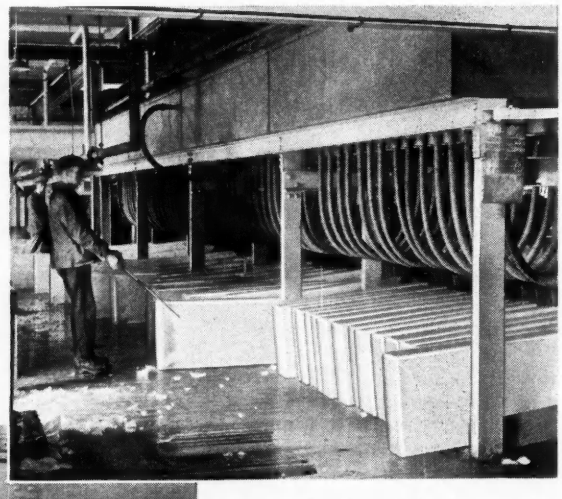
Twelve long-distance thermometers, by the Malone Instrument Co., are connected to the tanks and cold-storage chambers, enabling temperatures at all points to be kept under constant observation from the compressor room.

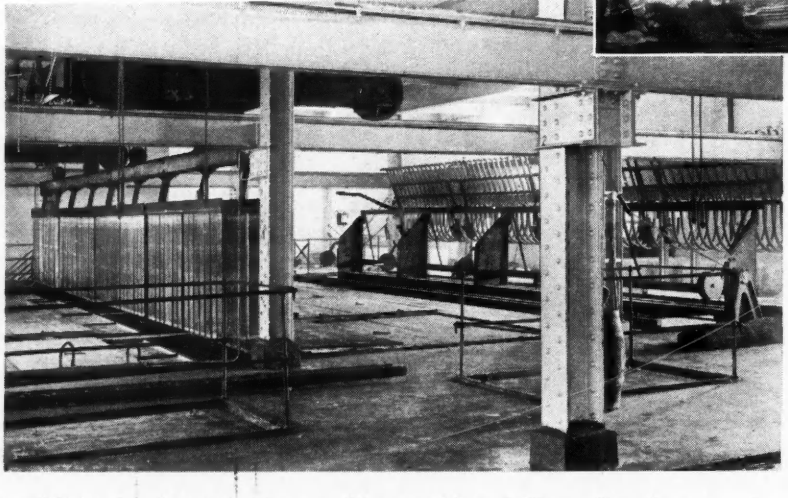
The water for ice-making, which is obtained from the Corporation at a maximum temperature of 62 deg. F., is somewhat peatish in colour and is treated with the aid of alum and soda in a " Pulsometer " filter. The latter has a capacity of 20 tons per hr., the surplus not used immediately passing to a 150-ton tank on the roof.

The Freezing Process

The tank room, which occupies practically the whole of the first floor, contains two separate tanks, each 42 ft. by 44 ft. by 5½ ft. These are filled with calcium chloride brine, the temperature of which is kept at from 15 to 18 deg. F. (below 15 deg. the ice becomes too brittle for safe handling in large blocks). This brine, which has a specific gravity of 1.260 and itself freezes at −6 deg. F., turns the water contained in 1,920 2-cwt. cans into ice, the process taking about twenty-four hours with water at an initial temperature of 62 deg. F. (the lowest initial temperature recorded is 45 deg.).

The brine is cooled by the evaporation of ammonia around the tubes of coolers, 4 ft. by 16 ft. (two per tank), through which the solution is forced by four propellers driven by vertical-spindle squirrel-cage motors. Each tank has its own 9-ton crane with a span of 43 ft. Hoisting is done at four points, the drive being by a 9-h.p. motor; a 5-h.p. motor is used for travelling. Each lift puts 60 cans in four rows (6 tons) of ice on the deck at a time.





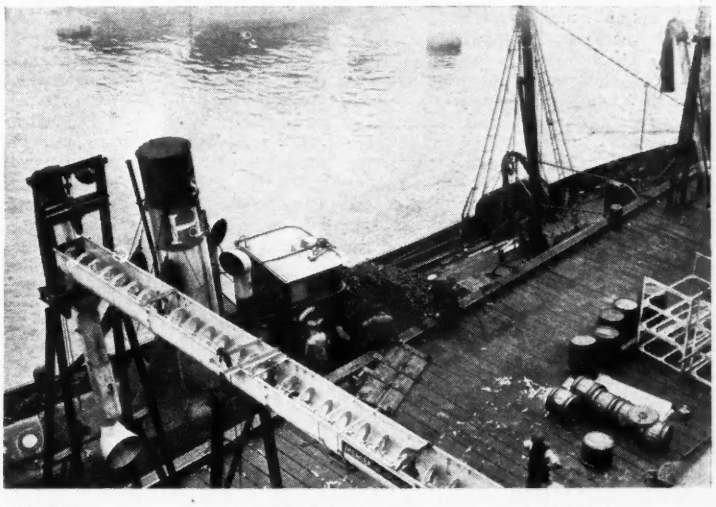
On completion of the freezing the cans are lifted into thawing tanks for a few minutes. Warm water for thawing is obtained either from a boiler or by passing the ammonia gas as it leaves the compressor through a heat exchanger by means of a 2½-h.p., 1,410-r.p.m. squirrel-cage motor. The empty cans are then automatically filled with 2 cwt. of filtered water each.

Left: Cans being raised for conveyance to "thawing" tanks seen on the right. Above: Blocks being removed from cans after "thawing"

Clean block ice for land sale is produced by liberating the air in the water in a certain proportion of the cans by means of agitation. For this purpose an air compressor (driven by a 7½/3½-h.p. induction motor), an air receiver and cooler, a central brine pump (driven by a ¾-h.p. motor) for drying and cooling the compressed air have been installed. The air is fed at 15 lb. per sq. in. to nozzles in the bottom of the cans.

Two crushers (driven by 15-h.p. squirrel-cage motors) on the ice deck feed direct into two worm conveyors which take the crushed ice direct to pipes terminating over the ships' holds. Each unit can deal with 30 tons per hour. A third motor-driven crusher is installed for the supply of ice to carts for merchants on the quay; there is also a dock for loading road vans.

Situated underneath the tank room are seven cold-storage chambers for edible produce with a total capacity of 68,000 cu. ft., and an ice store of 6,340 cu. ft. carries surplus ice from day to day. The chambers are heat-insulated with slab cork in Portland cement mortar or hot odourless rock bitumen. Piping and valves for the refrigerating machinery have been insulated where necessary with sectional covering finished with emulsified bitumen and asbestos blanket and cork have been used to prevent sound transmission. This part of the work was carried out by Newalls Insulation Co., Ltd.



Method of loading ice into a ship

As an indication of the calls upon the Ice Co.'s plant we were informed that the sixty trawlers which sail regularly from North Shields take a load from eight to fourteen tons of ice each on a fishing trip. In addition, French and Icelandic trawlers, requiring from twenty to sixty tons, are also dealt with. During the season, May to September, an average of 100 herring vessels have also to be supplied.

Three-phase Four-wire Metering. By G. W. Stubbings, B.Sc.

The need for a cheap and compact three-element instrument

THE accurate metering of a three-phase, four-wire supply in all conditions of current and voltage unbalance requires three single-phase meter elements. Usually, each of these elements carries a line current and is energised by the corresponding line-to-neutral voltage. It is possible to meter a four-wire load by means of a two-element three-phase meter connected in the usual way, and an additional element carrying the neutral current and energised by the white phase-to-neutral voltage. Both of these methods are accurate in all conditions.

In the two-wattmeter method of measuring four-wire power the two elements carry composite currents and are energised by line-to-neutral voltages. The component currents are obtained either directly by the delta connection of current transformer secondaries, or indirectly by the use of double-current windings. In this method the current which appears in both meter elements is virtually associated with the resultant of the two line-to-neutral voltages in the meter instead of that corresponding to it. If the resultant of two line-to-neutral voltages is equal and opposite to the third, or if the vectors of the three voltages form a closed triangle, then the two-element method is accurate however unbalanced the line-to-neutral voltages may be. Such voltages at the low-voltage terminals of a delta-star or an interconnected-star power transformer always satisfy this condition on no load, or with any three-wire load, however unbalanced. Further, the condition remains satisfied at any point on a distribution network fed by the transformer so long as the loading remains three wire, if the impedances of the mains are symmetrical. The error of a two-element meter is due only to a residual voltage at the metering position, and a residual voltage is normally set up by residual currents only.

Consider the case of a two-element meter measuring a single-phase load between white line and neutral, and assume that this is the only load supplied by the distribution transformer. The meter registration corresponds to the association of the white current with the resultant of red and blue line-to-neutral voltages. If the impedance of the neutral conductor is assumed to be negligible, this resultant will be the same as the white line-to-neutral voltage at the point of supply, and the meter will register the power input to the transformer instead of the power received at the metering position. If the impedance of the neutral be appreciable, the residual voltage, and hence the meter error, will be increased. Since the potential of the neutral at the point of supply is that of earth, the error of the meter can be reduced by connecting the common point of the voltage circuits to earth instead of the neutral main at the metering point.

If a three-wire load is now superposed on the single-phase load the error of the meter will still correspond to the association of the white-phase current with the residual voltage, but, as the currents in the red and blue phases will be correctly metered, the fractional error will be reduced. In the practical case of a considerable approximately balanced three-wire load, and an unbalanced four-wire load, the fractional error of a two-element meter can suitably be expressed in the form $IV\gamma \cos(\theta-\phi)/W$ where $V\gamma$ is the residual voltage, and θ is the phase difference of this residual voltage and the white-phase current. In the general case the angle $(\phi-\theta)$ may have any value between 0 and 180 deg., so that the fractional error of the rate of registration can vary between plus or minus $V\gamma/3$ V cos θ and zero.

A two-element meter can thus give considerable errors if the power factor of the load measured by it is low. If a practical limit of 0.5 is assigned for this power factor the fractional error will not exceed twice the ratio of the residual to the average line-to-neutral voltage. In the extreme case in which the red and blue voltages are each 6 per cent. high, and the white voltage 6 per cent. low, the fractional value of the residual voltage might be 12 per cent. The error of measurement of the power in the white-phase main would then be serious, and if the meter were measuring a combined lighting and power load this error might approach a value of 8 per cent. If the common point of the voltage circuits of the meter were connected to earth instead of to the neutral the residual voltage would be reduced and the meter error might be approximately halved. Thus, the multiple-earthed neutral system of supply, in addition to other advantages, may have that of increasing the accuracy of two-element four-wire meters.

The extreme conditions considered above are only likely to apply to a rate of registration over a limited time. The residual voltage which leads to inaccuracy of a two-element meter will vary both in magnitude and phase angle, so that, over a period, fast errors at one time will probably be cancelled by slow errors at another. The inherent possible errors of this method of metering four-wire loads are, however, those on which the value of the method must be assessed, and these inherent errors are seen to be serious. The development of cheap and compact three-element meters, is, therefore, very welcome.

High-frequency Furnaces

A booklet issued by the United Steel Companies, Ltd., entitled "Electric Steel Developments" summarises the results of some of the most topically interesting research work carried out at the laboratories of Samuel Fox & Co., Ltd., at Stockbridge, near Sheffield. This concern, it is claimed, is the largest producer of steel by means of high-frequency electric furnaces in the world, its plant of this type ranging from 5 cwt. to 5 tons, in connection with which the "Fox inclusion count" method enables the degree of cleanness to be assessed on a quantitative basis. Discussions are included on such matters as creep, inherent grain size, fatigue, interpenetration of non-ferrous metals, which with the data given on special steels for various purposes should make the publication of value to engineers interested in electric furnace development.

Luminescence. By J. N. Aldington, B.Sc., A.I.C.

The conversion of ultra-violet radiation into visible light

CERTAIN chemical compounds, more particularly those containing definite small amounts of impurity, have a peculiar property by virtue of which they glow with characteristic colours when exposed to ultra-violet light. In some cases the visible glow ceases immediately the ultra-violet radiation is removed, while in others the substances continue to glow, but with gradually declining intensity, for some time afterwards. These luminescent effects, called "fluorescence" and "phosphorescence," respectively, have lately aroused considerable interest because it has been found possible to utilise them to an increasing extent in various forms of the electric discharge lamp.

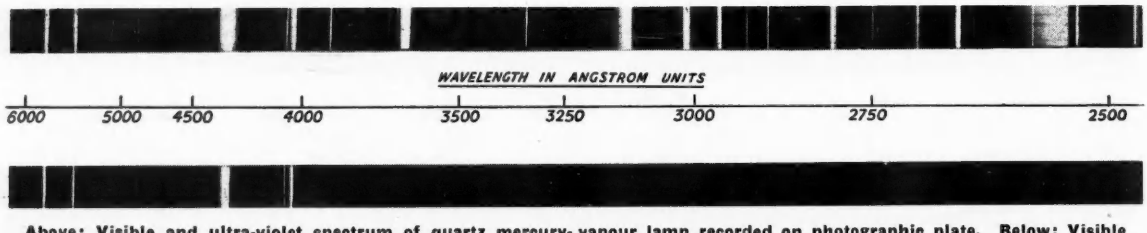
In general, in considering the application of luminescent compounds to discharge lamps it is unnecessary to distinguish between the associated phenomena of fluorescence and phosphorescence. The source of ultra-violet radiation is, in most cases, in continuous operation and the required luminescent effect is then associated with the visible light from the electric discharge lamp. The purpose of using luminescent substances in such association is to produce either a different coloured light source, a more efficient light source, or a source having a light emission closer to that of daylight than the primary radiation from the discharge lamp. In Table I are summarised some applications of luminescent materials to discharge lamps, with a broad indication of their effects.

TABLE I.

Type of Discharge Lamp.	Luminescent Compound.	Resultant Effect.
High-voltage low-pressure mercury sign tube.	Calcium tungstate... ...	Highly efficient blue tube.
Ditto.	Zinc silicate	Highly efficient green tube.
High-voltage low-pressure neon sign tube.	Calcium tungstate... ...	Efficient pink or violet tube.
Ditto.	Zinc silicate	Efficient yellow tube.
Hot-cathode low-voltage low-pressure mercury tube.	Mixtures of powders ...	Reasonably white light.
Ditto.	Calcium tungstate... ...	Highly efficient blue tube.
Ditto.	Zinc silicate	Highly efficient green tube.
Sodium vapour lamp ...	Rhodamine varnishes on street signs.	The signs show clear red when illuminated by sodium vapour lamps.
High-pressure mercury-vapour lamps.	Zinc cadmium sulphides of various compositions. Other modified zinc sulphides.	Improved colour of radiation from the lamp, due to addition of red light.

This table is intended to indicate in a general way some of the more important applications of luminescent materials to discharge lamps and does not purport in any sense to be exhaustive.

For a combination of discharge lamp and luminescent material to be useful and efficient it is necessary, first, for the discharge itself to be rich in ultra-violet radiation capable of exciting fluorescence; secondly for the luminescent material to be stable and capable of being applied to the lamp or tube without its efficiency being impaired; and thirdly, for the luminescent material to emit visible light of a useful colour for the purpose for which it is required.



Above: Visible and ultra-violet spectrum of quartz mercury-vapour lamp recorded on photographic plate. Below: Visible spectrum of mercury-vapour lamp as perceived by the eye

The mercury discharge lamp fulfils the first condition mentioned above very satisfactory. Both the low-pressure mercury discharge tube and the arc of the modern high-pressure lamp emit radiation over a considerable region from the remote ultra-violet into the infra-red up to about 13,500 Angstrom units. Due to the limitations of the human eye, only a limited portion of this range is perceived and hence the region from about 4,000 to 7,000 A.u. is called the visible spectrum. One of the accompanying photographs illustrates the emission from a mercury discharge lamp operating in a quartz envelope—the photographic plate faithfully reproduces the ultra-violet as well as the visible region; the other shows the effect as perceived by the eye—the ultra-violet region appears completely dark. It is evident from this that luminescent materials are valuable because they can absorb the invisible radiation from a mercury discharge lamp and re-emit it at a higher wavelength as useful visible light.

Application to Inside of Mercury Tubes

There is now a considerable patent literature dealing with the application of luminescent compounds to the inner surface of tubes within which a low-pressure, low current-density mercury discharge takes place. Many different types of binder have been suggested for wetting the inner surface of the tubes, for example, dilute solutions of waterglass or a solution of boric acid in glycerine. After a suitable sticky film of binder has been produced, the luminescent material in the form of a fine powder is sprayed or otherwise coated over the inner surface of the tube. Subsequent operations involve the removal of volatile matter from the tube by heating and finally its fabrication into the desired form of discharge lamp.

In the case of mercury tubes, an excess of mercury, together with a filling of a few millimetres pressure of inert gas, is used for carrying the discharge current. With quite low current densities in the tubing, of the order of 10 mA per sq. cm. of cross section, suitable luminescent materials are strongly excited and glow brightly with characteristic colours. Efficiencies as high as 60 lumens per watt may be obtained with zinc silicate, provided that the power density is correctly related to the current density in the discharge, and even higher values have been obtained experimentally.

The use of luminescent materials in high-voltage sign tubes has provided many new pastel shades of colours and much increased luminous efficiencies. Combinations of coloured glass tubing and fluorescent coatings may be used still further to increase the range of colour shades.

Fluorescent Glasses

Special tubing in which fluorescent materials are dispersed in the inner layers of the glass have been available for the manufacture of high-voltage sign tubes for a number of years. The tubing is designed for use with the low-pressure mercury discharge and a variety of colours from blue to bright pink can be obtained. One variety of this tubing, having a flashed opal exterior, gives a pleasing white light when excited by mercury vapour. As only a superficial layer on the inner surface can be effectively excited, the efficiency of tubes employing these fluorescent glasses is somewhat lower than powder-coated tubes. Nevertheless they can be manufactured to give efficiencies several times greater than that of the unmodified low-pressure mercury discharge lamp.

Maintenance of Luminous Efficiency

Both types of luminescent discharge tubing mentioned above have a gradually declining luminous efficiency during their life. This decline is due to surface deposits which prevent full activation of the luminescent powders or glass, and is somewhat dependent on the manufacturing technique. The use of the inert gases refered to above has been found to prevent this gradual diminution in luminosity and, particularly with tubes internally coated with powders, it is possible to produce luminescence by using discharges in argon, neon, krypton or xenon or a mixture of two or more of these gases. The effects with neon are particularly valuable and may be mentioned here as examples of this method. Table II shows the effect of using different current densities in a neon tube coated internally with zinc silicate.

TABLE II.

Current density in tube.	Intensity of neon glow.	Intensity of green fluorescence.	Resultant colour of tube.
High	High	Practically constant	Orange
Normal	Medium		Yellow
Low	Low		Pale green

The green fluorescence of the zinc silicate becomes practically saturated at low current density and produces the dominant effect from the tube. At higher current densities the neon red glow becomes more predominant and a beautiful yellow colour results from its combination with the green glow of the luminescent coating. At still higher current densities the neon discharge largely masks the effect of the luminescence and the tube appears orange. The great virtue of such tubes is their high luminous efficiency maintenance over life—there is practically no diminution in the effect of the fluorescence.

Many years ago Cooper-Hewitt attempted to improve the colour of his mercury-vapour lamps by using coatings of

rhodamine—a red fluorescing dyestuff—on reflectors surrounding the lamp. Among other things, the gradual decomposition of the rhodamine, together with its absorption of visible light, rendered the experiments of little practical value.

The development of inorganic fluorescent powders, capable of being activated by radiation from the mercury discharge lamp in the near ultra-violet, has led to much experimental work, the object of which is to produce a light source which will give colour renderings closer to that of daylight than are obtained by the unmodified mercury lamp. For this purpose the primary light emitter may be one of the standard mercury discharge tubes now familiar to all lighting engineers. It may with advantage be one of the more recently developed high-pressure lamps operating in a quartz tube. In each of these cases the fluorescent powder is applied to the inner surface of an outer envelope within which the discharge tube operates.

In order to achieve satisfactory colour discrimination the light source must emit radiation covering the whole of the visible spectrum. In common with all electrically excited gases and vapours, the radiation from mercury is confined to a few isolated wavelengths, so it is important to use luminescent materials which cover as wide a range of wavelength as possible. As the dominant radiation from the mercury lamp is yellow-green, it follows that both blue and red radiation must be added if satisfactory colour rendering is to be obtained. In general then it is desirable to coat the bulb surrounding the mercury discharge with a mixture of powders which will strongly luminesce in the blue and red region of the spectrum and to use such densities of powders on the bulb as will most effectively produce the desired results.

With the types of powder which are at present available it is a matter of compromise as to what ratio of primary radiation from the mercury lamp to secondary radiation from the luminescent material is most desirable. Various zinc cadmium sulphides may be used for adding red light to the mercury lamp radiation, and, up to a point, increased powder concentration appears beneficial. Beyond this point, although further increases in red light are produced with increased powder densities on the bulb, the band spectrum of the fluorescent material, extending into the yellow region, gives to the emitted light a pronounced yellow hue.

This effect may be partially counteracted by using an increased percentage of blue fluorescent powder on the bulb and the choice of the most suitable combination is a matter of some debate. In spite of these difficulties, however, there can be no doubt that the luminescent high-pressure mercury discharge lamp will represent an effective step in the development of a more perfect light source.

Stability of Luminescent Materials

The inorganic luminescent materials which may be used in conjunction with electric discharge lamps are in general extremely stable when correctly applied and operated at low temperatures. At higher temperatures certain of them, particularly those suitable for use in combination with the high-pressure mercury lamp, have a decreasing efficiency and when raised to a sufficiently high temperature the luminosity of the powder completely disappears. In most cases the powder is not damaged and on returning to a lower temperature the full luminosity is restored.

A study of the characteristics and behaviour of luminescent compounds under temperature changes is necessary so that the maximum efficiency shall be obtained for any design of lamp, a lamp with a cold outer jacket coated with powder being the ultimate ideal. A compromise between the opposing functions of minimum bulb size and minimum temperature must be effected in any practical design of lamp.

Arc-Suppression Coils. By H. W. Taylor, A.M.I.E.E.

Experiences in their operation in Great Britain

THE unusual number of interruptions of supply experienced during the first half of 1934 due to lightning led Edmundson's Electricity Corporation, Ltd., with which I am connected, to investigate additional means of lessening the inconvenience thereby caused to consumers.

The installation of lightning arrestors was felt to be only a partial palliative in regard to overhead lines. Another line of action was to allow the interruption to occur, but to cut down its duration to a minimum by installing auto-reclosing circuit-breakers at many, and particularly the remoter, parts of the network. As most of the interruptions caused by lightning are due to flash-overs on insulators which in the majority of cases result in no serious damage that would prevent the line being switched in again after thirty seconds or so the advantage as compared with manual operation is readily apparent.

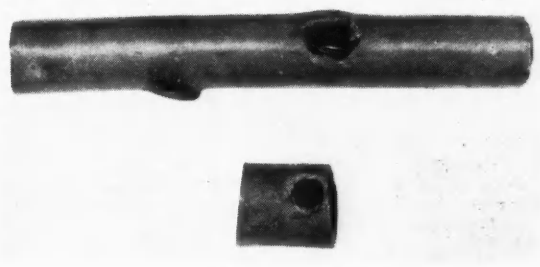
In the United States the problem has been carried a stage further in many cases by the installation of switches which open and close again within a few half cycles, which means that for all practical purposes there is no interruption of supply at all. This apparatus, however, would prove too costly for application on the average 11-kV and 33-kV rural networks of this country.

The ideal appeared to be some means whereby even if a flash-over should occur the damaging follow-through power arc would be prevented. The answer was thought to be an "arcing-ground suppressor," sometimes known as a "Petersen" coil after its inventor.

The principles of operation of such a coil have recently been given in the ELECTRICAL REVIEW (June 25th, 1937), so all that need be said here is that it is a tapped reactance inserted between the neutral point of a system and earth. When an earth fault of zero resistance occurs on any phase of a three-phase system operating with an unearthed neutral a current flows through the fault equal to three times the normal capacity current of any one phase to earth, which capacity current depends upon the length and type of lines in circuit at the time and is independent of the amount of load they may be carrying.

By means of the taps provided the coil can be previously tuned so as to be ready to supply a current approximately equal and opposite to this earth capacity current and the current through the fault immediately falls to a negligible value. If the fault persists the network will continue to operate with one phase earthed at the fault. If, on the other hand, the fault is occasioned by a flash-over on an insulator the phases soon resume their normal relationship with earth after the arc has been extinguished. In either case there is no violent disturbance of the system or need to interrupt the supply.

The more the experiences of Continental users of this type of coil were examined the more were the claims of its sponsors confirmed. So much so, indeed, that one felt that there must be a "snag" somewhere, else why had we in this country not adopted it when apparently it had been so successfully applied abroad that, on interrogation, certain German operating engineers vouchsafed the opinion that it was the best piece of protective apparatus adopted for many years past? Its non-appearance in this country cannot be ascribed to our regulations, which specify that a point on a high-voltage network must be connected to earth, as the Electricity Commissioners readily approved it as a method of earthing which appeared to



[*Elec. Rev. photo.*

Damaged sections of cables which continued to operate satisfactorily until repairs could conveniently be carried out

increase safety and improve the continuity of supply. The only explanation seems to be that the existence of such a piece of apparatus was unknown to the vast majority of supply engineers in this country, although in Germany one or more are installed on almost every important network.

It was finally decided that arc-suppression coils should be given a trial, and during the last three years several have been installed. The first was installed in October, 1934, on the 11-kV network supplying Andover and the surrounding neighbourhood, followed two months later by another at Braintree on a network supplying a large part of Essex. These two networks are mainly overhead lines, but include an average amount of underground cable. The total lengths of lines and cables are eighteen miles at Andover and 134 miles at Braintree, the two continuously rated coils being for 7 and 26 A, respectively.

That the first year's operation was satisfactory can be judged

from the fact that of the twenty-seven earth faults which occurred in Andover only two resulted in interruptions of supply.

The same encouraging results were also obtained at Braintree, where there were twenty faults of all types recorded throughout the year, three being phase-to-phase faults (with which, of course, the coil cannot deal) and seventeen earth faults. All the latter were taken care of by the coil, with the result that the network only suffered three interruptions of supply instead of the twenty which would undoubtedly have occurred had no coil been installed.

Encouraged by these experiences, further 11-kV and 33-kV coils were installed in Cornwall, Wiltshire and East Anglia, and their operation has proved equally satisfactory. For instance, during 1936 twenty-three faults due to lightning and salt mist were recorded on the 33-kV network in West Cornwall, yet no interruption of supply occurred throughout the year. This compares remarkably with the operation of the resistance-earthed 11-kV network in the same area, which is subjected occasionally to bad lightning storms and often to salt mist conditions. It would also seem to provide a satisfactory answer to those who have wondered whether a coil could successfully deal with flash-overs that occur under fog conditions, which would be conducive to a simultaneous flash-over on one of the other two sound phases, while momentarily subjected to full line pressure to ground.

It is expected that by the end of this year at least twenty-six coils will be in service on networks ranging from small 11-kV to large 66-kV systems of the undertaking referred to.

Cable Faults

The question is sometimes asked whether the coil is equally efficacious in preventing interruptions of supply on underground as on overhead systems. That this is so will be seen from the following three instances in connection with the three-core, 11-kV lead-covered cables in the networks previously mentioned:

A watchman was driving spikes into a roadway in a remote village as supports for red lamps. One of them punctured a cable, causing a short between one core and the lead sheathing. The watchman was unaware that anything was wrong until the engineers arrived 2½ hours later, having located the fault in the section of cable in this village. To avoid inconvenience to consumers, which would have been caused by an immediate disconnection of supply, the repair (which merely necessitated the fitting of a joint box) was postponed until after midnight. In all, the cable operated satisfactory for eleven hours in the damaged condition. Subsequent examination showed that no burning had taken place, the damage being entirely mechanical due to the driving in of the spike.

A cable was damaged by a labourer's pick during excavations in a farmyard. The coil operated and indicated the presence of a permanent fault. The system continued to operate in this condition for approximately twenty-four hours before the fault was repaired. Here again the damage was found to be that due solely to the blows received from the pick.

A workman damaged a cable while working in a roadway excavation and a few sparks were emitted. The local engineer, by allowing the cable to operate in its damaged condition for about two hours, was able to obtain an alternative supply from another source and so disconnect the faulty section without interrupting the supply to important power consumers. The damage to the cable was so slight that it was sufficient merely to strip back the lead and fit a joint box without cutting the cores.

These instances are sufficient to show that on ordinary rural networks, containing as they do a certain amount of cable, the coil will satisfactorily deal with any fault which occurs between one core and the lead sheath, which is an initial condition in the vast majority of cable faults. Moreover, provided the coil is reasonably accurately tuned no burning will occur which might cause the trouble to spread to another core.

On very large cable networks, which may have residual earth current of upwards of 100 A, it is generally considered advisable to limit the duration of a sustained fault to a few minutes or hours, depending on the type of cable in use, as a current of this magnitude flowing through the fault for an appreciable time would probably burn the insulation sufficiently to cause a short between two phases.

Answers to Criticisms

Among the criticisms that have been published is one to the effect that an insulator punctured by lightning must be detected and changed at once as the next fault might be on one of the other phases, resulting in the line tripping on overload; if this disconnection reduced the capacitance of the system by 30 to 40 per cent. the coil, it is said, would become inoperative just when most required as several faults may occur in a few minutes during a lightning storm. This is not borne out in practice, as the experiences referred to indicate. The explanation may be that for every insulator punctured there must be dozens which merely flash over, when, with a coil in circuit, the extinction of the power arc prevents any damage being done and the system continues to operate in as sound a condition as before. If, however, the neutral of the system is earthed in the normal way serious damage to the insulator will almost certainly occur (accompanied not infrequently by the conductor being burnt through), rendering it necessary to disconnect the faulty section for a considerable time.

Three observations suggest themselves in regard to the implication that the coil may be rendered inoperative if 30 to 40 per cent. of the network is disconnected on overload. First, the usual practice is to run the coil undertuned to the extent of 10 to 20 per cent. (at which it is perfectly satisfactory for 11 kV and 33 kV), so that to exceed the limits of tolerance over 50 per cent. of the network would have to be disconnected, a proportion that must surely be very uncommon on a properly laid-out system of any appreciable size.

Secondly, the tolerance of 30 to 40 per cent. can be frequently exceeded in practice, as shown by tests on a 33-kV coil at Fraddon, when a 6-in. arc was extinguished with 83 per cent. dissonance. Thirdly, if attendance at the main substations is either continuous or is provided when thunderstorms are imminent the tuning of the coil can be appropriately altered if any considerable portion of the network has to remain disconnected.

Detection of Punctured Insulators

With reference to the objection that the detection of a punctured insulator would be difficult as the absence of earth-fault current precludes the use of fault indicators, nothing could be more out of keeping with actual practice, for the following reasons:—

(1) For the purpose of fault localisation the coil can be short-circuited and use made in the ordinary way of the earth-leakage protection, which would normally be fitted on a network to which a coil has been added as an afterthought. This is to be recommended even on new networks designed for normal operation with a coil as there may be occasions when the coil is out of commission, due possibly to maintenance or temporary interconnection with other networks not arranged for arc-suppression coil protection.

(2) The section in which the faulty insulator occurs, if on a ring main, can often be localised without interruption of supply to consumers by feeding the network in two separate parts from two transformers, one operating uncarthed and the other with the coil in circuit. By switching a section at a time from one transformer to the other the faulty one can be detected the moment it is switched on to or off the transformer having the coil connected to the neutral. Interruption of supply would be limited to the time taken to locate the insulator in the faulty section and confined to consumers connected to that section.

(3) In practice, the finding of a punctured insulator has proved simplicity itself, much simpler than either of the two above-mentioned methods. With the line dead such an insulator is often difficult to locate, necessitating the climbing of each pole and possibly even the removal of the binding. With the line alive and a coil in circuit the insulator was readily detected by the red glow occasioned by the leakage current which could be easily observed from a considerable distance.

(4) The absence of a large earth current does *not* preclude the use of fault indicators. A simple type of directional earth-indicating relay can be fitted to circuit-breakers controlling different feeders, which indicates that on which a permanent fault exists. These relays can be arranged to trip the breaker if desired, but the more usual practice is to use them as indicators only.

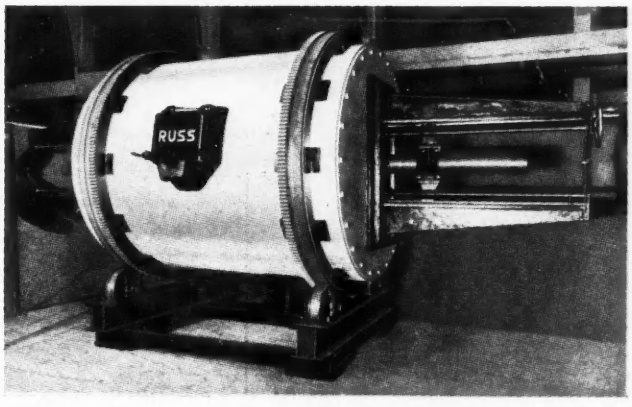
Interruptions Not Prolonged

It has also been suggested that although the number of interruptions of supply may be slightly reduced those which do occur are likely to be prolonged, and that the device being inoperative immediately following the tripping out of any considerable section of the system may have serious consequences owing to a second fault occurring before the coil can be adjusted. Each of these suggestions is refuted by experience in the field. The several engineers of this undertaking who have now had upwards of three years' practical experience of the benefits accruing therefrom unhesitatingly agree that the installation of a coil has greatly reduced the number of interruptions; those that do occur are not more prolonged, but the reverse; and that there is no serious risk of disastrous consequences on account of the coil being out of tune.

Electric Rocking Furnace. By A. J. G. Smith

Details of construction and performance

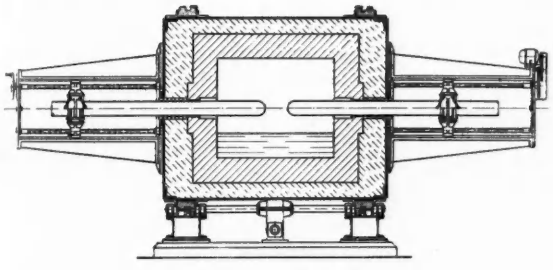
IN view of the attention which has been devoted of late in technical circles to the performance of "rocking" or drum furnaces fired by gas it should not be overlooked that some extremely interesting results have also been obtained from the same kind of furnace when electrically heated. A considerable amount of development work in arc type rolling furnaces has been carried out both in the U.S.A. and in Germany; in America over 700 installations have been put down. They have been successfully used for metals with high melting points, among which may be mentioned electric steel, tool steel, special heat-resisting steel, grey iron, malleable iron, as well as a number of metals requiring lower melting temperatures, such as copper, gunmetal, brass and aluminium. They have also found a further field for the superheating of iron and steel in the duplexing process for the production of special quality metal, and they have been successfully used for melting glass and enamel.



A 1-ton Russ rocking furnace

Some Advantages

A feature of the rocking furnace is that it is capable of an extremely high production relative to its size and initial cost, so that the capital expenditure on such an installation can be very quickly written off. An improved quality of metal is obtainable owing to the extremely close control of temperature, combined with the thorough mixing of the charge which is ensured through the rocking of the hearth. Samples of the melt can be easily obtained during progress of the heat by bringing the furnace to a standstill at its forward position and opening the tapping hole. A slight pressure is obtained in the melting chamber during the progress of the melt which prevents the ingress of free air, and melting losses are reduced to very small proportions; for instance, in the case of copper alloys containing up to 85 per cent. Cu. the melting loss has been kept down to 0.5 per cent. The cost of crucibles, which is a serious item in most foundries, is eliminated with this design, and this is not offset to any marked extent by lining repairs and renewals. Heating-up is effected very rapidly, which makes the furnace suitable for almost all working programmes, as this feature enables it to be used advantageously either for a few hours per day or per week or when continuous working is called for. In addition, there can be put into the balance all the usual advantages pertaining to electric heating, not the least of which is the marked improvement in the comfort and health of the workers resulting from the better conditions rendered possible in foundry work by the use of electricity.



Section through furnace

A very good idea of the latest German developments in this class of furnace can be gathered from the practice of Industrie Elektroofen G.m.b.H., of Cologne, whose Russ type furnaces are now being made in this country. The accompanying illustration shows a typical 1-ton arc-type rocking furnace, and the details of its construction can be seen from the sectional view. It consists of a substantial steel drum fitted with a machined ring at each end resting on a pair of rollers. Rocking of the furnace charge is effected by an electric motor operating the supporting rollers through adjustable reversing gear, provision being made so that the speed and amount of rock imparted to the furnace charge can be varied within the limits of the so-called safe rock. This is determined by the angle within which the solid metal of a new charge will not damage the electrodes, or the molten metal of a finished melt run into the spout.

The electrode brackets and adjusting devices are mounted at each end of the drum, adjustment being by hand in the smaller sizes and by electric motor in the larger. Charging is effected through a suitable door in the periphery of the drum, which is so arranged as to serve also as a pouring spout for running off the finished melt. The melting chamber is of cylindrical form, and the refractory lining can be built either of standard arch or specially shaped bricks. Alternatively, a rammed lining is often used.

Underneath the refractory lining is a suitable thickness of insulating material to reduce heat losses. Specially shaped refractories are used for the electrode guides and for the charging door with run-off spout.

Consumption Figures

The following figures illustrate the results obtained in actual practice with Russ type rocking furnaces of various capacities and with various metals. They are useful as an indication of present-day German practice, but owing to the difference between English and German conditions with regard to industrial tariffs, wage rates and cost of materials it would be misleading to quote actual German figures against individual items. Therefore, for the purpose of approximate comparisons, the figures showing total melting costs are given.

Temperature, deg. C.	1,150	1,500	1,650	1,250 to 1,650
Metal	Cu. alloys (up to 85 Cu.).	Nickel alloys.	Electric grey iron.	Duplexing.
Capacity of furnace, cwt. ...	2	5	10	20
Average melting time, min. ...	30	60	150	30
Charging and pouring time, min....	15	30	30	15
Rating, kVA	85	150	200	(a)
Working day, hours	8	16	24	24
Melts per working day	10	10	8	32
Output per working day, tons ...	1	2½	4	32
Current per ton, kWh	300	600	575	150
Electrode consumption per ton, lb.	5¼	11	10	3¾
Water consumption per ton, gal....	330	660	550	440
Attendance, man hours	8	16	24	72
Total German melting cost per ton at par exchange (b)	£1/9/9	£2/5/3	£2/18/9	13/5

(a) Not recorded.
(b) This figure includes not only the costs named in the above table, but also allowance for furnace lining, maintenance, and depreciation of plant.

To supplement the table the following are the kWh per ton consumption figures with various other metals: Steel castings, 750; special steels, 950; copper, 350; aluminium, 500; and glass, 600. These figures are based upon 24-hr. continuous working.

International Broadcasting Union

The above Union has concluded its 1937 summer meeting at Ouchy, Lausanne. Monsieur Rambert (Switzerland) presided, and delegates attended from the broadcasting companies of twenty European nations, as well as a number of observers from other interested organisations. The Programme Committee's recommendations were adopted by the Council. The Technical Committee reaffirmed that it had not been possible to solve the several serious cases of interference in the long waveband by the Lucerne Plan or by arrangements with other radio services. In the medium waveband a higher stability of certain transmitters made it possible to reduce interferences now existing. At the request of an inter-continental meeting recently held at Bucharest by the Union the Technical Committee prepared a programme of tests, involving the close collaboration of American stations. These tests will take place within the next few months so that the results obtained may be used by the Cairo Conference in 1938 in the preparation of a world plan for the distribution of short waves. The Technical Committee confirmed the advantage resulting from the adoption of synchronised transmitters for national systems, as compared with the system of waves shared between different countries. In addition, the Committee has continued its regular studies regarding microphones, studio acoustics and anti-interference campaigns in co-operation with the Comité International Spécial des Perturbations Radiophoniques. The Juridical Commission also continued its studies.

Carrier Telephony.

By S. P. Chakravarti, M.Sc.(Eng.), A.M.I.E.E.

A two-wire system for non-loaded cable circuits of the air-space paper-core type

IN recent years there has been considerable progress in the application of carrier-current telephony to non-loaded cable circuits of both the air-space paper-core and co-axial types. Systems developed include the experimental one of Clarke & Kendall at Morristown, U.S.A., with a frequency band of 4 to 40 kc. per sec. with nine carrier channels and 25-mile repeater spacing, and those of the British Post Office from Bristol to Plymouth, 12 to 60 kc. per sec., twelve channels and 20-mile spacing, and from London to Birmingham, 0.5 to 2.1 Mc. per sec., 320 channels and seven-mile spacing. The first two employ cable circuits of the air-space paper-core type and the third of the co-axial type.

The invariable features in all system developed hitherto for operation on non-loaded cable circuits are: (1) the four-wire principle, using "go" and "return" circuits in the same cable with efficient screening between them or in two different cables in the same or neighbouring ducts; (2) stabilised negative feed-back amplifier at terminals and repeaters, giving gain up to 90 dB with stability and freedom from cross-modulation; (3) separate automatic pilot-wire regulator or pilot-channel system for regulating gain and thereby overcoming the effect of temperature variation; and (4) carrier-suppressed single side-band method of transmission.

I have recently developed a low-frequency two-wire single-channel carrier telephone system suitable for simultaneous operation on physical and phantom circuits formed of two pairs of wire in a non-loaded cable.* Transmission tests have been carried out on a small length of air-space paper-core multiple-twin cable of Pirelli-General manufacture. The present article deals with the application of the system to existing non-loaded cable circuits on trunk routes with suitable repeater spacing and cross-talk balancing arrangement and shows that the cost of equipment for the same number of channels is less than with the h.f. four-wire system for distances up to 150 miles and for a number of channels not exceeding twelve.

Outline of the System

The frequency band involved is 3.0 to 8.2 kc. per sec. With a transmission direction from A to B, the carrier frequency is 6.21 kc. per sec. and the band transmitted is 6.21 to 8.21 kc. per sec. From B to A the corresponding figures are 5.076 and 3.076 to 5.076. Since the frequencies involved are not much higher than voice-frequencies, attenuation and cross-talk are such as to permit carrier-telephone channels to be worked on physical and phantom circuits simultaneously and in all six telephone channels (*i.e.*, three v.f. and three carrier) have been obtained on two pairs of wire in each quad.

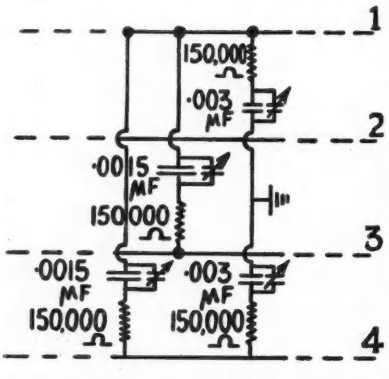


Fig. 1.—Cross-talk balancing network

Part transmitted carrier (about 40 per cent.) and one side-band method of transmission have been found to be more suitable for this system than the carrier-suppressed single side-band method for the following reasons. As voice-frequency and carrier telephone channels are to be operated simultaneously on each of the three circuits formed of two pairs of wire, the carrier bands in each circuit are liable to additional phase-shift on account of their transmission through line filter sets at terminals and repeaters. With single side-band transmission, this may ultimately give rise to appreciable phase-distortion, but with the method described this possibility has been eliminated, since both carrier and side-band frequencies undergo roughly the same amount of phase-shift. The variation of circuit attenuation, due to variation of resistance and dielectric conductance with change of temperature, is sufficient at the frequencies involved to justify incorporating an automatic volume-control device. A separate pilot-wire regulator or pilot channel can be dispensed with and a small fraction of the transmitted carrier can be utilised to control the gain of repeater amplifiers automatically. The cost of modulation at the transmitting end is slightly reduced, and the carrier generator at the receiving end is eliminated. Even the arrangement for reamplification of the carrier by selective regeneration at the receiving end has been dispensed with, since the percentage of carrier transmitted is just sufficient to reproduce the speech at the demodulator without appreciable wave-form distortion.

The desired fraction of the carrier transmitted has been directly adjusted by a transmitting band-pass filter and not by the "carrier compensation method" adopted in some existing systems. The direct method costs less than the latter and introduces negligible phase-shift of the wanted side-band frequencies with respect to the carrier frequency. Four-element, double-m type of filter sections with suitable value for frequency of infinite attenuation have been found to give the characteristics required for adjusting 40 per cent. of the carrier.

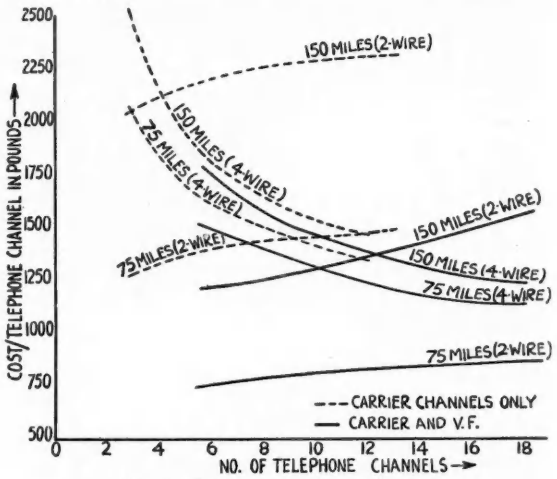


Fig. 2.—Cost per telephone channel

A repeater section of fifteen miles has been proposed for non-loaded a.s.p.c. cable circuits of copper gauge of 10 lb. per mile as suitable for simultaneous operation of my system on physical and phantom circuits. The attenuation in a repeater section calculated from measured values is given in table I.

TABLE I.

Circuit.	Attenuation in dB at frequencies in kc per sec.						
	2	3	4	5	6	7	8
Physical ...	16.3	17.1	17.8	18.3	19.6	22.1	25.1
Phantom ...	15.1	15.6	15.6	15.6	15.8	16.1	17.5

Attenuations at the highest frequency transmitted are 25.1 and 17.5 dB for the two circuits. (For voice-frequency working on the two-wire principle permissible attenuation in a repeater section is 25 to 30 dB.) A carrier repeater capable of giving a maximum gain of about 30 dB will be adequate.

Circuit attenuation undergoes variation due to temperature change. Assuming a change of about 10 deg. C. at 2½ ft. below the ground surface, the variation in attenuation of the above repeater section has been calculated to be about 2.2 and 1.8 dB at 8 kc. per sec. for physical and phantom circuits, respectively. Hence, provision for automatic volume control by utilising a small portion of the transmitted carrier has to be made.

From measured values of cross-talk and attenuation of circuits physical-phantom and physical-physical cross-talks at near and distant ends have been roughly calculated for a repeater section of fifteen miles by methods suggested by A. Morris*. Table II shows the cross-talk figures before balancing.

TABLE II.

Frequency in kc per sec.	Physical-phantom dB.		Physical-physical dB.	
	Near.	Distant.	Near.	Distant.
3.0	78.4	64.4	106.4	91.0
4.0	77.8	64.0	108.3	92.2
5.0	77.4	63.3	102.3	86.0
6.0	77.35	63.1	92.2	74.4
7.0	77.0	62.5	92.0	72.0
8.0	76.1	61.0	88.0	65.0

The cross-talk figures obtained for unbalanced sections are satisfactory. For balancing, each repeater section can be

* *Revue Generale de l'Electricité*, March 27th, 1937.

* Paper No. 126, Institution of P.O. Electrical Engineers.

divided into one-mile lengths, each of which is separately balanced by measuring wire-wire and pair-earth unbalances of its component portions at 8 kc. per sec. and reducing them to small values in the complete section by selection and crossing of wires at joints. In a factory length of 0.1 mile of multiple-twin cable maximum wire-wire and pair-earth capacity unbalances are about 100 and 150 $\mu\mu$F, respectively, and insulation resistance unbalance about 1,000 ohms. After these balancing operations the residual wire-wire and pair-earth capacity unbalances will be roughly about 10 and 20 $\mu\mu$F, respectively, in 0.1 of a mile. A cross-talk balancing network of the type shown in fig. 1 inserted at the centre of the repeater section will give further improvement. Ultimately, physical-phantom and physical-physical cross-talk figures at the near and distant ends will be at least 10 to 15 dB more than the figures in table II at the highest frequency.

Comparison of Cost

In table III are given the relative costs of equipments for the same total number of channels obtained by superimposing two-wire and four-wire carrier systems on two pairs of wire in non-loaded cable. For my two-wire system, carrier equipment at the terminal consists of three single-channel terminal equipments. There are no carrier oscillators on receiving sides of the channels. Since the same frequency bands are transmitted from the same direction, one common oscillator can be used for three channels on transmitting sides. Carrier repeaters are to be spaced fifteen miles and v.f. repeaters thirty miles apart, so that both carrier and v.f. repeaters are to be installed at alternate repeater stations. It will be sufficient to provide equalisers only with amplifiers dealing with the frequency band 6.2 to 8.2 kc. per sec. in each channel. A separate pilot-wire or channel system is unnecessary here.

For operating a h.f. four-wire system, carrier equipment at each terminal will consist of master oscillator, multi-frequency generators and tuned circuits, in addition to usual channel apparatus. Stabilised negative feed-back amplifiers are to be provided both at terminal and repeater stations. Using the same gauge of wire, repeaters are to be spaced 18.75 miles apart. Equalisers are to be of more elaborate type and provided with both "go" and "return" amplifiers at the repeater stations. A separate pilot wire or channel system will be necessary, since no carrier is transmitted.

Since efficient screening is essential between pairs in the h.f. four-wire case, its cost at £8 per mile has also to be added. For calculating the cost for twelve channels in the two-wire case the cost of two extra pairs of wire, together with that of another set of similar equipments, has been taken. Fig. 2 shows the cost per telephone channel for operating 75 and 150 miles of circuit by each system. It will be seen that the cost for the same number of channels (taking both v.f. and carrier) is less with the author's two-wire system for distances up to 150 miles provided the number of channels does not exceed twelve. For longer distances and a greater number of channels the four-wire carrier system is more suitable.

A few points arise for discussion. Since frequencies above 2 kc. per sec. have been removed, articulation as calculated from Fletcher's curves is 75 per cent. Articulation can be improved considerably by allowing up to 2.5 kc. per sec., which increases the width of band employed in the system by 1 kc. per sec. The overall transmission characteristic measured for transmission on a small length of cable shows that amplitude distortion is negligible. By superimposing the system on longer circuits amplitude distortion will be appreciable on the band between 6.2 and 8.2 kc. per sec. and has to be corrected by an attenuation equaliser. Phase distortion has been practically eliminated by transmitting a fraction of carrier with the side-band and by adopting the direct method of adjusting percentage of carrier by filter. Wave-form distortion is also negligible, since the amplitude of the carrier at the demodulator is just sufficient to produce an envelope similar to that of signal at the transmitting end.

TABLE III.

Two-wire system on two pairs of wire		Four-wire system on two pairs of wire.	
Items.	Cost of equipment (relative).	Items.	Cost of equipment (relative).
1. Carrier terminal equipment, including hybrid set.	£310 per channel per end.	1. Carrier terminal equipment, etc.	£560 per channel per end (average).
2. V.f. terminal equipment.	£100 per end.	2. V.f. equipment, etc.	£100 per end.
3. Repeaters :— (*a*) V.f. two-wire. (*b*) Carrier, including line filter sets.	£45 each. £100 each.	3. Four-wire repeaters, negative feed-back type.	£100 each.
4. Equalisers at carrier repeaters.	£10 each.	4. Equalisers at terminals and repeaters.	£35 each.
5. Cross-talk balancing network.	£20 per repeater section.	5. Cross-talk balancing network.	£20 per repeater section.
6. Hybrid set with line balance at v.f. repeaters.	£10 each.	6. Pilot channel equipment.	£600 each.
7. Repeating coils for phantom working repeaters.	£5 each set.	7. Testing equipments at terminals and repeaters.	£100 per station.
8. Testing equipments at terminals and repeaters.	£100 per station.	8. Excess charge under cable plant for screening.	£8 per mile.

For obtaining twelve channels it would be better to superimpose carrier systems on pairs in two different quads separated from each other by one or more quads so that the latter might serve as screens.

The design of transmitting band-pass filters to transmit 40 per cent. of the carrier together with the side-band is not difficult.

An attenuation rise of 8 dB in 200 cycles per sec. between carrier and wanted side-band and of 32 dB between carrier and unwanted side-band is all that is required. A four-element double-m type of filter section has been found to satisfy requirements. For transmitting a still smaller percentage of carrier the rise of attenuation characteristic has to be much steeper.

I wish to express my thanks to Professor C. L. Fortescue for suggesting the examination of this problem and for numerous discussions with me on the subject.

The Smaller Undertakings' Proposals.

AS a counterblast to the Ministry of Transport's memorandum on the reorganisation of electricity distribution the Committee of Smaller Municipal Electricity Supply Undertakings has sent to the Minister a series of proposals which, it considers, will achieve the objects aimed at in a more equitable and acceptable manner.

Briefly, the suggestions are that the Electricity Commissioners should set up investigation committees to consider and report upon the following points :—(*a*) Anomalies in bulk-supply charges and methods. (*b*) Forms of tariffs and supply systems with a view to standardisation. (*c*) The terms for the hire and sale on hire-purchase of appliances and installations to secure greater uniformity. (*d*) The compulsory establishment of showrooms by supply authorities, together with contributions to national propaganda, the introduction of suitable tariffs and appliance-supplying schemes and the extension of supply to all built-up areas.

After receiving the reports of these committees the Electricity Commissioners should proceed to define areas and call upon the authorities in each area to set up a co-ordinating committee vested with powers to :—(*a*) Secure a uniform standard of tariffs and conditions of supply throughout the area. (*b*) To take the necessary steps to correct any factor which may preclude any authority from conforming with requirement (*a*). (*c*) To make necessary mutual adjustments to remove anomalies within the area for the benefit of "boundary" cases. (*d*) To secure mutual arrangements which in the committee's opinion will lead to increased economy and efficiency of supply.

Any undertaking which felt that it had been unjustly dealt with should have the right of appeal to a tribunal with an independent chairman who should be a member of the legal profession.

It is claimed that such a scheme as this would remove the fear of confiscation with which inefficient undertakings are threatened. If they failed to fall into line public opinion would demand improvements. Moreover, the procedure would "facilitate development on traditional lines and would follow the trend of democratic development."

As to rural areas, the Committee thinks that development could best be carried out by a levy upon the whole of the electricity supply industry, instead of burdening some of the medium and small undertakings with the cost. There is seen to be much further scope in urban areas and it is suggested that valuable experience would be gained if the Committee's proposals were to be operated on a voluntary basis for a period of five years, the position being reviewed at the end of this time.

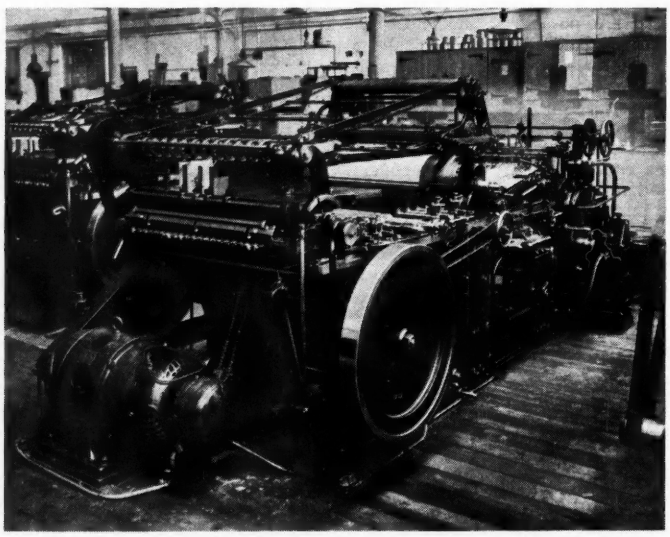
The Committee feels certain that such methods would be more likely to accelerate development than the procedure recommended by the McGowan Committee or that outlined by the Ministry.

Printing Works Change-overs. By T. H. Lockett

Where the retention of d.c. drive may be desirable

IN the various articles that have been written dealing with the change-over from d.c. to three-phase a.c., certain aspects do not seem to have been touched on. Some of these are well illustrated in the case of a small printing works where the business is largely of a jobbing nature. The plant to be driven can be roughly divided into three sections: typesetting, machining and binding. The first and last sections do not present any unusual difficulties, the motors required generally being constant-speed fractional-h.p. machines for typesetting machinery and 3-to 10-h.p. constant-speed machines in the binding department. All these can easily be replaced by squirrel-cage motors arranged for star-delta or straight-on-line starting, according to the requirements of the supply undertaking.

The machining or letterpress department, however, presents certain problems, and the easy way out of providing variable-speed slip-ring motors with their large and cumbersome rotor resistances does not give the printer anything to equal the facilities which he enjoys with the modern d.c. variable-speed motor. Letterpress machines frequently require an equipment with a two to one speed range, and when engaged on colour printing the speed must be kept nearly constant for technical reasons often over a number of days. The load of a machine, however, may vary considerably over this period due to differences in temperature, the size of the forme and the number of inking rollers in use. With the usual somewhat coarse gradations in speed obtained with the slip-ring motor and its series characteristic, this constancy of speed is difficult to obtain. In addition to these drawbacks it will often be found that the bill for electricity increases, particularly if there is any charge dependent on power factor. This is obviously unfair as the consumer has not asked to be changed over.



Demy cylinder printing machine with commutator motor drive

There are two alternatives before the supply undertakers, both of which give the consumer facilities more closely approaching his existing d.c. service. The first is to install a bulb-type mercury-arc rectifier. This has many points in its favour, the outstanding ones being low capital and installation costs and compactness of the apparatus. It is usually possible to find the small space required on the consumer's premises for a 25-kW set, approximately 6 by 3 ft. In two instances within my knowledge the following figures were obtained: 30-kW rectifier, including installation, £300 (alternatively changing motors, £500); 20-kW rectifier, including installation, £233 (alternatively changing motors, £390).

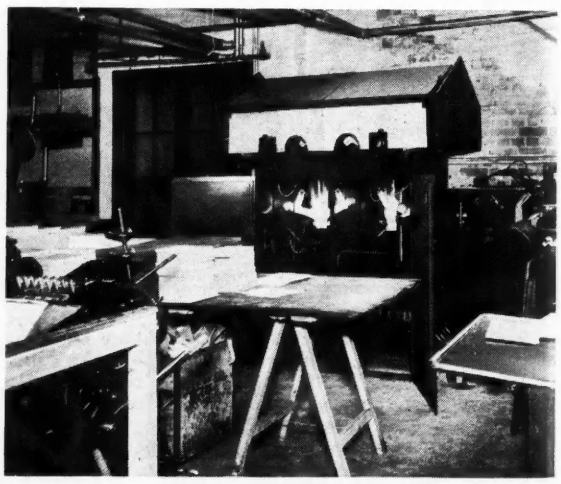
Rectifiers have already been installed in many printing works and have given every satisfaction. The undertaking saves considerably on installation as the factory has not to be completely rewired for three-phase and the consumer is saved the disorganisation attendant on a number of wiremen being in his works for some weeks. Most of the benefit, however, lies with the undertaking and if the latter takes this easy way out it should be willing to meet the consumer over certain points which it is sometimes loth to do. First, the metering should be on the d.c. side so that the consumer does not have to pay for the rectifier losses, or if this is not compatible with the rules of the undertaking, since the rectifier once installed is the property of the consumer, an allowance varying between 10 and 15 per cent. should be made on the power consumption—the lower figure for 400-V and the higher for 200-V supplies as rectifiers are less efficient on the lower voltages.

The next and important point is that the rectifier should be of the double-bulb type, both bulbs being able to cope with, say, 75 per cent. of the full load of the whole factory, and connected in parallel to share the load. The possibility of breakdown or mechanical damage to the glass bulb of the rectifier is remote, but duplication in this way is only fair, and even then the cost of the change-over is probably only 40 per cent. of that required if all the motors are changed. There is no need to duplicate the rectifier transformer as this is a piece of apparatus that rarely, if ever, breaks down. Maintenance of these rectifiers is negligible and their operation consists merely in switching on the a.c. supply and closing the breakers feeding the d.c. system. A voltage regulation of 6 per cent. between no load and full load is obtained on the latest types.

The alternative to the mercury-arc rectifier is a composite scheme using squirrel-cage induction motors for constant-speed drives but installing shunt-characteristic commutator motors where variable-speed motors are required. These motors, which have now got over their teething troubles (mostly connected with commutation) possess all the good points of the modern d.c. variable-speed motor and in some respects are even better. The variation of speed obtained by the differential movement of two sets of brushes over the commutator gives an infinite number of steps between bottom and top speed with a very even gradation.

While the motor may look somewhat complicated, the design is such that there is little chance of breakdown. Control gear is of the simplest, all that is required being a contactor starter with a separate inching contactor, interlocked so that the motor can be started only in the bottom-speed position. Their efficiency is comparable with a d.c. motor, and their power factor is generally round about 0.9. In comparison with the slip-ring type the saving in electricity over a year, assuming that the motor is run generally at about 60 to 70 per cent of its full speed, can be fairly safely taken as in the region of 20 per cent. These motors are, however, not favoured in change-over schemes, largely owing to their relatively high cost and also because of difficulties in installation.

As, in order to keep down the starting current, the brushgear has to be brought to the minimum speed position before starting there is waste of time in going round to the smaller motors to make the required adjustment. One type of equipment, however, is provided with a neat arrangement of remote control for the brushgear, consisting of a hand wheel with an arrangement whereby an adjustable stop can be fixed at various positions; this is connected by chain and wire rope to



Novolin rectifier, seen with doors open, installed in a printing works at Guildford

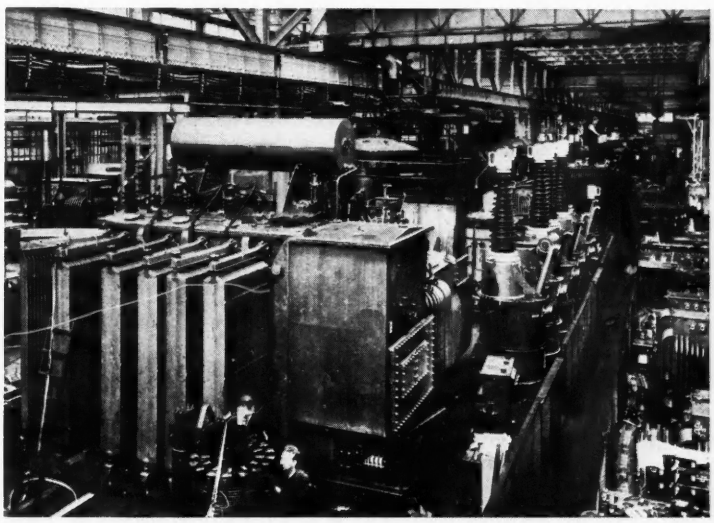
Domestic and Industrial Apparatus

Work in progress at Rugby

ALTHOUGH it is the fashion to connect industrial activity with rearmament, we found on a recent visit to the Rugby works of the British Thomson-Houston Co., Ltd., that its three-storey home appliance factory was just as busy as the "heavy" departments.

This activity was especially noticeable on the top floor allocated to the manufacture of refrigerators. In this work—more perhaps than in the production of any other piece of domestic apparatus—laboratory accuracy is required, *e.g.*, the clearances between the piston and cylinder of the compressor are only 0.0006 in. and assembly is carried out in a dustproof air-conditioned chamber. The compressor and its motor are run in an air-tight welded steel case with a charge of lubricating oil which has to withstand intimate contact with the sulphur-dioxide refrigerant. Before the latter is admitted the unit is evacuated down to one eight-thousandth of an atmosphere during the drying process.

"Torribar" heating elements are being turned out at the rate of 3,000 and 2,000 per week for boiling plates and immersion heaters. The resistance wires are inserted in tubes fitted with dry magnesium oxide, after which the tubes are swaged and bent. The tubes are made of "Inconel" (a new alloy of nickel and chromium) for the boiling rings and of copper for the water heaters.



The Transformer Factory at Rugby

Adjacent to the assembly line of the Hotpoint cookers were the silent running washing machines with their distinctive oscillating four-winged geared gyrators and provision for attaching an ironer and adjusting height. The introduction of other domestic appliances in the near future was foreshadowed by Mr. H. Lingard (director, B.T.H. and Hotpoint Companies). These include a dish washer which is expected to be ready next March.

In the home appliance factory all machine tools have individual electric drives and are arranged so that the work flows continuously in one direction. Welders controlled by thyratrons are conspicuous in this part of the works. Up to 1,500 welds per minute, we were informed, can be obtained. High speeds not only save time but secure the precision that is essential when welding thin and certain metals. With thyratron control the current is switched on and off automatically for each weld and the duration of the welding time is set by the operator by means of a potentiometer. One air-operated continuous spot welder deals with cooker plates up to $\frac{1}{8}$ in. thick. Another machine is for flash-welding cabinets, the two edges to be joined forming the electrodes; when they are brought together current is switched on simultaneously and all oxidised metal is squeezed out. About $\frac{5}{16}$ in. of metal is used in making the weld.

The effect of automatic machinery is, however, most noticeable in the old and new lamp works, where about 1,000 miles of tungsten wire is used each week. While this trend has speeded up output so that the production is close on 300 lamps per. sq. ft. of space per year as against less than 60 in 1922, it has not eliminated the need for manual dexterity of a high order among employés. There is plenty of evidence, too, of the intensive nature of the research that is being carried on in further developments in mercury-vapour discharge lamps.

Examples of modern engineering at the other end of the scale are to be found in the turbine department. That the reliability of 33-kV generation is now established is shown by the adoption of this method for a 50,000-kW alternator for Ironbridge, one of 51,600-kW for Kearsley and another of 30,750-kW for Coventry. Other large turbo-alternators in hand include a 60,000-kW set for the new Littlebrook station of the Kent Electric Power Co., a 25,000-kW set for Glasgow Corporation Transport Department, and a second 30,000-kW extraction unit for Ford's Dagenham Works. The last-named is designed for initial steam conditions of 1,200 lb. per sq. in. and 900 deg. F. For overseas a number of sets up to 15,000 kW (for Hong Kong) are in course of manufacture. It is somewhat unexpected nowadays to come across new turbo-generators for so small an output as 150 kW, but there were half a dozen of these (6,500 r.p.m.) for marine service among the many relatively small units for industrial use now being built.

Several large winder equipments are under construction for the gold mines in South Africa. Two of these are Ward-Leonard Ilgner sets, each comprising a 2,988-h.p., 200-r.p.m. d.c. winder motor and a 40-ton flywheel motor generator with commutator-type slip-regulation for its 2,800-h.p. induction motor. Also for the South African mines (underground service) are two 1,100-h.p. a.c. winder motors with air-break reversing contactors and control gear.

The first rectifiers to be employed by the L. & N.E.R. for traction (on the Newcastle-South Shields line) as part of an order for complete equipment of four unattended sub-stations with distant supervisory control present another indication of

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Printing Works Change-overs

(*Continued from previous page*)

the pinion which operates the brushgear. The stop is set for any given speed, and on restarting the motor the operator merely turns the hand wheel to bottom speed position, presses the start button and then brings the hand wheel back against the stop, when it will run at the pre-arranged speed. On equipments of 15 h.p. and over the brushgear is usually operated by a pilot motor and the mechanical contrivance is not needed.

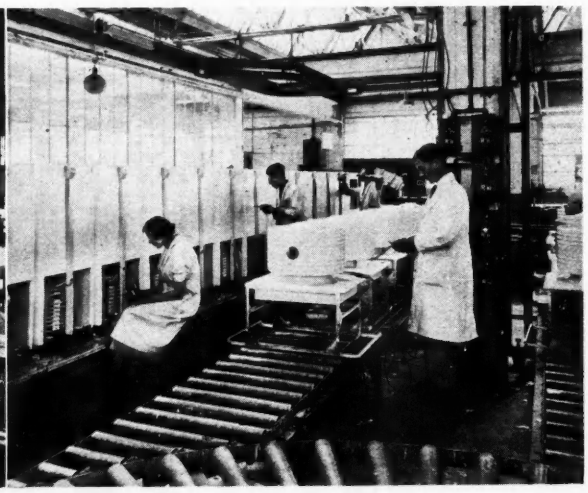
These commutator motors give a performance similar to that of a d.c. motor, and they have the great advantage over the slip-ring motor that for any given setting of the brushes the speed will be practically constant. A commutator machine with fixed brushgear has been recently introduced, the speed regulation of which is obtained by means of an induction regulator; so far, however, this has only been made up to 3 h.p., and, generally speaking, the equipments met with in smaller works vary between 3 h.p. and 7 h.p.

A question that seems to remain undecided is whether the consumer should be called on to contribute towards the expense of the change-over. In my experience only one supply authority has asked for such a contribution and then it was only about 10 per cent. of the total cost in two cases when the totals were £750 and £250. The motors to be taken out in the smaller job were very old and one would think it only fair that as the consumer no doubt obtained adequate abatement of income-tax on account of their depreciation, he should pay a little towards the new equipments to be put in for him. It would be interesting to know what would eventually happen if a consumer refused payment of such contribution. Have the authorities the right to change his motors and sue for payment or can they, as has been suggested, change the supply and leave him to change his motors or move?

In my opinion the interests of both the undertaking and the consumer are best served if the following is used as a broad basis for considering a change-over. If the consumer has largely constant-speed motors driving groups of machines through shafting and only one or two variable-speed equipments, a complete change-over to a.c. motors using squirrel-cage and commutator motors should be made. If, on the other hand, the works is a progressive one with a number of modern variable-speed d.c. equipments it is better for the consumer and the undertaking to install a mercury-arc rectifier, making it clear, of course, that all additional load is to be connected to the a.c. supply.

modern tendencies. These are 1,000-kW, 630-V units. At the opposite end of the transformer factory from that occupied by the multitudinous small distribution transformers are such large examples as the 40,000-kVA unit for Brighton and the 132-kV, 30,000-kVA and other somewhat smaller units for the C.E.B. For Bristol there are two 18,000-kVA transformers and two oil-immersed magnetically shielded reactors to give 10 per cent. reactance on 18,000 kVA. There are other reactors, too, of different design. There is also a 4,000-kVA furnace transformer for providing 11,550 A at several secondary voltages.

Variable-speed motors (ranging from 50 to 140 h.p.) for driving in seven sections a 200-in. paper machine for Tasmania



Left: The Mazda Lamp Works. Right: Refrigerator assembly

may be taken as examples of the progress that is being made by a.c. commutator motors in printing and other works where close speed regulation is required. Such machines (some for cranes with Selsyn units for operating in synchronism with each other) and "No-lag" power-factor correction motors are notable features of the motor factory where machines up to 800 h.p. are in hand with control gear for all types of service.

Although the works are so fully occupied, it was clear from the activity in the research laboratory that further progress in the future is being ensured by investigations into any branch of electro-technics that is likely to meet with a practical application. All the foregoing developments imply the ability to carry out accurate checks at any stage of manufacture and the measurement room is as important in the organisation as it is interesting to the electrical engineer. Measuring standards, precision tools and gauges in use throughout the works are here compared frequently with master standards, which are in turn referred to the National Physical Laboratory every few years. Each machine in this room is equipped with an optical indicator and by focusing a lamp through a lens on to mirrors a magnification of 5,500 is obtainable. Some of them are capable of measuring within one-millionth of an inch, which is required in many cases to secure the fine limits worked to in practice after allowing for the usual tolerances.

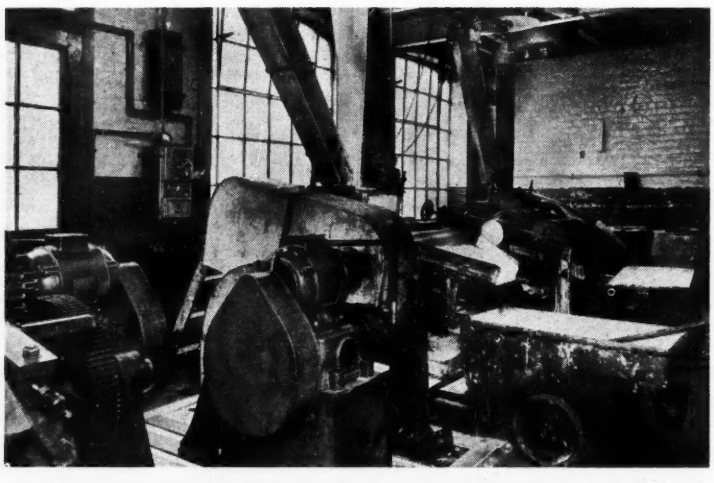
Electricity in a Paint Works

THE Hull works of Messrs. Storry Smithson & Co., Ltd., at which paints, enamels, varnishes and anti-corrosive and anti-fouling compositions for ships are manufactured, has recently been completely reorganised and changed over from steam engine to modern electric drive. The whole of the electrical equipment installed was manufactured and supplied by the General Electric Co., Ltd.

All materials are taken to the top of the factory for the mixing machines, which are driven through line shafting by a 30-h.p. squirrel-cage motor mounted in the roof of the factory. There are also two horizontal mixers, which are driven by a 10-h.p. s.c. motor through a chain to existing shafting. The motor is fitted with two clutches, one for each of the two mixers, which enable the drive to be taken up gradually and also allow one mixer to be cleaned out while the other is running. After the colours are mixed to the correct consistency the material flows to grinding machines on the second floor. The latter comprise three rolls, each weighing half a ton and made of porphyry, a type of hard granite. The pressure between the rolls is four to five tons per sq. in. The rolls are used to grind the colour and ingredients together to form a homogeneous mixture and are driven by 7½-h.p. back-geared slip-ring motors. For white lead paints a separate machine is installed, having six rolls and driven by a 15-h.p. 720-r.p.m. squirrel-cage motor through a chain to existing main-line shafting utilising the fast and loose pulleys. This stiff paint, or pulp, is afterwards taken to vats and thence, if required, into further mixers, driven by a 5-h.p. 950-r.p.m. s.c. motor through existing belt shafting. Oils and varnishes are introduced at this point. The next process is one of further grinding in circulators, which are driven by a 5-h.p. s.c. motor installed in the roof, the drive again being taken through existing line shafting.

The works was originally powered by an old 100-h.p. twin-cylinder vertical steam engine installed in 1900. One of the disadvantages of this drive was the fact that the mixing machines would pull up the old engine dead and, furthermore, it was necessary to start up the central plant in order to operate any small mixing machine.

Electricity from Hull Corporation's mains is brought in at 400 V, 3-phase, 50 cycles, and is taken direct to a main 300-A circuit-breaker. The supply is then divided into four circuits feeding various distribution boards in the mill. Each circuit is controlled by a 60-A oil circuit-breaker fitted with three overloads, and a watthour meter for costing purposes. The s.c. motors are controlled by direct-to-line starters fitted with three magnetic overload trips and ammeters. The slip-ring motors, however, are controlled from air-break rotor starter panels, the stator switches having three overloads and fitted with ammeters; isolating links are provided in all cases. The above description applies to only half the works; the remainder, at present d.c., will be changed over in due course.



Paint-grinding rolls driven by 7½-h.p., 1,410-r.p.m. back-geared motors

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Registration and Inspection

The remarks of Mr. T. G. Kelly are to the point as registration has, unfortunately, proved to be quite ineffective in stamping out jerry contractors; indeed, I feel, as a registered contractor, that registration in this country is merely a nice heading on notepaper.

Mr. Kelly says that he sometimes thinks that "cut prices and jerry work are the easiest money," and there is no doubt that under existing conditions many first-class contractors find it difficult to make a living by working to a standard. Personally I would be glad to clear out of contracting, but one has to make the best of it and endeavour to eke out a living by working for the few sensible clients who still put quality before price.

Mr. Kelly asks: "Why not some immediate action?" That is a question I have been asking for years, but it is like water running off a duck's back and *bona fide* contractors do not seem to realise that a real fighting spirit will have to be assumed if they wish to put their house in order. Any real help in the direction indicated cannot come from the supply side of the industry due to vested interests and *bona fide* contractors are quite capable of "tackling" the situation themselves if they really wish to do so. When do they intend to make a start in earnest? I am ready to assist.

Glasgow, *July 3rd.* ALEX. MILNE, A.M.I.E.E.

Electricity and Gravitation

With regard to Mr. Verschoyle's letter in your last issue, there appears to be some connection between terrestrial currents and variations in the ohmic resistance of sections of the earth's surface to such as earth leakage currents originating from some artificial source of supply, *e.g.*, a generating station. In this event the efficiency of apparatus which depends upon the conductivity of the earth for its energising current would be directly affected by the laws which govern the production, strength and direction of terrestrial currents.

Unfortunately, I have no knowledge of the experiments conducted by Mr. Verschoyle, nor of the Carnegie Institute discoveries, but in common with many of your readers I possess certain notes and facts which may assist towards finding an explanation of certain phenomena, such as the connection between electricity and gravitation.

I have seen statements to the effect that explosion risks in collieries are greater when wind in strength from the south-west is either present or expected. The Gresford pit disaster occurred during a southerly gale, and at the time of writing another explosion is reported to have occurred at a Stoke-on-Trent colliery. The curious fact is that a northerly wind has prevailed for a long period in this part of the country, but that day it had moved to the south and the weather forecast was "freshening south or south-west winds." While this may be a matter of coincidence the connection between pit explosions and southerly winds has evidently been noted to account for the "folk lore."

As a southerly wind is warm in summer, there would probably be a temperature increase in any space ventilated by warmer air. Southerly winds in winter are, however, frequently very cold and pit explosions occur at all periods of the year. Possibly explosion risks link up with terrestrial currents—in addition to other influences—because the direction of wind, and possibly its strength, appears to be governed by some electrical phenomena.

In connection with this note, in Liverpool we have a wide river and excellent ferries, which for a number of years past I have used each evening. I have noticed that the direction of the wind can be forecast for twenty-four hours, or longer, by apparent changes which occur in the distant shore lights. These lights are mostly electric and are therefore constant; the apparent change which is observed must therefore be due to a change in the atmosphere between the point of observation and a light which may be a mile or more distant. The interesting point is that the changes are indicated in the "colour band," which is not due to the condition of humidity, temperature and the more obvious explanations ruling at the time of the observation, but to some other factor which only changes many hours in advance of the forecast change in the wind direction. It seems apparent that whatever causes the change in the appearance of distant lights is the factor which decides the direction the wind is to take. It appears to be quite possible that it is the appearance and direction of some terrestrial current.

As a final note, I have observed that under certain conditions small currents when conducted through soil can create a very high resistance in their own path until no current can flow. This is very important in connection with earth-leakage trip gear, but the same action may also occur with terrestrial currents after they have been maintained for a certain period of time. Afterwards, their direction would change because of the resistance they had created in their original path, but this original path may also be the path for current to energise protective relays employed in a transmission system and which for the time being would be inoperative. Consequently, the failure of a protective system at a particular time may not be due to any defect in the system itself, but to the temporary interference of a terrestrial current. A. G. BULLEN.

Liverpool, *July 2nd.*

Earth Leakage Protection

In reply to the "Writer of the Article" I am fully aware of the consequences if the trip coil becomes short-circuited, and I wish to eliminate any risk of this by removing all redundant earth wires and unnecessary parallel connections.

With regard to Mr. Bullen's remarks, the authority I mentioned is no less than the Wiring Regulations Committee itself, and if he will make the usual application he will find that 1005 (c) is intended to permit the parallel or series connection of leakage trips

The authority in Germany employing most leakage trips definitely abandoned multiple earthing some fifteen years ago; this also applies to the smaller users. For all overhead distribution in these areas the neutral is earthed at one point only—the sub-station; all other leakage protection is by means of leakage trips. For confirmation of this I would suggest application to the Rheinisch-Westfälisches Elektrizitätswerk A.G. preferably to Director Heinisch at the Wesel office.

Folkestone, *June 25th.* T. C. GILBERT.

A British Columbia Development

WORK has commenced near Vancouver, British Columbia, Canada, on the second set of an 188,000 h.p. power development programme for the British Columbia Electric Railway Co. The new addition is being made to the Ruskin power plant, which is one of ten large hydro and steam plants serving the company's system. Provision for the installation of this second set was made when the first was installed in 1930 and the final installation will consist of four sets.

The new power plant will add 47,000 h.p. to the power resources of the company. The Ruskin project utilises the water of Allouette Lake for the third time and the waters of the Stave River for the second time, so that the new installation is the last of a chain of three hydro-electric stations, and when the two additional installations are completed the Ruskin plant will represent the ultimate development of the Stave-Allouette group on the lower mainland of British Columbia, approximately thirty miles from the city of Vancouver. The group comprises 12,100 h.p. of automatic plant at Allouette, which was put into commission in 1925. Waters of the Allouette Lake are brought by a tunnel to this plant and then flow into the Stave Lake and ultimately the Stave River. Down the river is the Stave Falls plant, which was built in a number of units, the first being completed in 1910 and the final unit in 1925, bringing the capacity of this plant up to 77,500 h.p.

Owing to the system under which this chain of stations has been developed, the reservoir of the Ruskin plant, which was completed in 1930 and is also capable of serving the present unit, functions merely as a forebay and only daily regulation of these waters is possible. The reservoir is approximately seven hundred acres in area. There is approximately a 1,300-ft. head of water available, which represents the total fall between the tail race of the Stave Falls plant 3¼ miles up-stream and the average height of water below the Ruskin dam.

The Ruskin plant was erected on the east side of the river, immediately below the dam, and when the initial unit was completed in 1930 two tunnels were bored leading to the power house. Connections are now being made with the second tunnel in order to utilise it in connection with the present expansion programme. The power dam is 400 ft. long at its crest, while its total height from foundations in the river bed is 185 ft. In order to prevent leakage and erosion in the sandy

formation a curtain of steel piling 600 ft. long and averaging 50 ft. in depth was driven to bed rock when this dam was constructed. On the dam crest are seven tainter gates, each being 33 ft. wide and 26 ft. high, with a traffic bridge surmounting the dam top and a flume cutting through the dam on the west side. One of the special features of this dam was the introduction of an inspection gallery 16 by 4 ft. in cross section from bank to bank which permits inspection for seepage and serves for drainage purposes.

The tunnel which is now being utilised, together with the one bored at the same time and used for the original installation, are both 24 ft. in diameter. The average length of the tunnels is about 300 ft. A penstock with a diameter of 19 ft. and erected in 80-ft. steel lengths is now being constructed by the Dominion Bridge Co. The back filling with concrete of the penstock and the lining of the tunnel will both be completed about the end of this year. A butterfly valve for control of the water at the power house end of the penstock will be installed. This will be similar to the valve in the present unit and is being supplied by the Dominion Engineering Works.

No additions will be necessary to the power house for the installation of the new set. The new generator will be a vertical machine supplied by the Canadian General Electric Co. and rated at 44,000 kVA, 3 phase, 13,800 V, 60 cycles, at 120 r.p.m. It will have a Kingsbury thrust bearing and directly connected exciter unit. The set will be 33 ft. in diameter and approximately 65 ft. in height from the bottom draft tube. The rotor is to be about 28 ft. in diameter.

The Dominion Engineering Works is supplying the vertical reaction type Francis turbine. The weights of the rotating parts of the generator and the turbine, together with the hydraulic thrust, will be about one million pounds, all of which will be suspended from a single thrust bearing.

The Canadian General Electric Co. is again supplying the three main single-phase step-up transformers each rated at 14,667 kVA. Each of these will weigh over 83,500 lb. and be over 19 ft. in diameter. In addition, this company is installing three 10,000 kVA step-down transformers.

The I.E.E. Conversazione

THE Conversazione which has been held by the Institution of Electrical Engineers for so many years at the Natural History Museum, South Kensington, loses none of its interest if the numbers of those who attend form a true criterion.

On July 1st the President and Mrs. H. T. Young received 1,950 members and guests—a figure far higher than many supposed, to judge from unofficial estimates heard during the evening, but the building lends itself well to the accommodation of such a large throng without overcrowding. This leading social function of the electrical world provides an unequalled opportunity for meeting friends from all over the country and from overseas also, although electrical engineers from abroad had a conversazione of their own a few days later (on Wednesday this week).

[*Elec. Rev.* photos

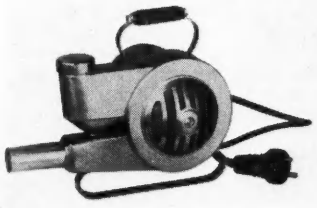
1. A "conversation piece." 2. The President, Mr. H. T. Young, and Mrs. Young. 3. A section of the large gathering

Electricity in Horticulture

Recent advances

THE use of electricity in horticulture has made good progress during recent years; for instance, soil heating is a simple method of forcing greenstuffs, it being possible to maintain a temperature of 50 to 56 deg. F. during March and April for a normal frame 6 ft. by 4 ft. on from 7 to 10 kWh per week, and tests have shown that lettuces can be grown in the spring at a cost of less than 1 kWh per head. In addition, for flowers, luminous radiation is beneficial, good results being obtainable from lamps of only 15 W. For large-scale work, however, electric-discharge lamps can be utilised. In addition to heating and irradiation, electricity can play an important role in fumigation and sterilisation.

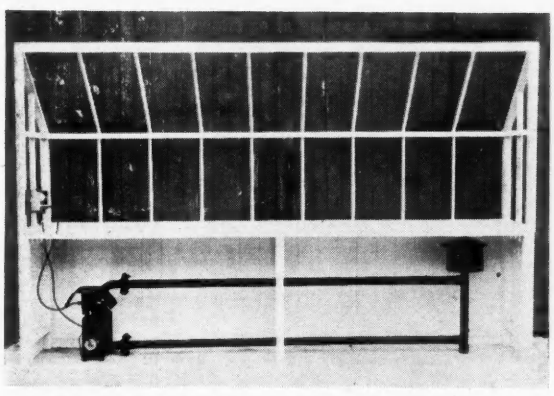
Some interesting equipment of this kind was exhibited at the Chelsea Flower Show by the Electro-Horticultural Equipment Co., Ltd. The exhibit included, in addition to neat panel heaters, soil-heating cables, thermostatic switches and fumigators which were shown last year, several new lines. For greenhouse and soil heating, corrosion-resisting metal strips are available, operating at 12 V from a special 1½-kW transformer. Both the low-voltage strip and the panel heaters are supplied with a waterproof thermostatic control board incorporating a switch, a thermostat set to act at 60 deg. F. and a vacuum switch rated at 2 kW.



The Electro-Horticultural Co.'s insecticide blower

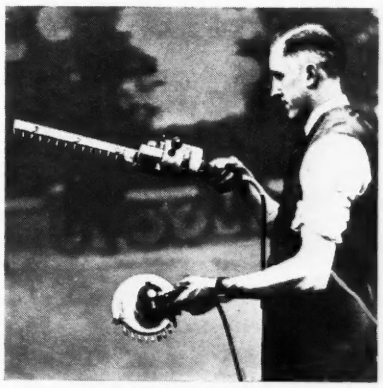
For hot water greenhouse installations the same company is supplying electric boilers fitted with immersion heaters loaded at up to 10 kW; for fuel fired boilers automatic stokers are made. A small propagating frame measuring 47 in. by 20 in. with a 100-W heater has been introduced and the soil sterilisers have been greatly improved and are now made of steel. The consumption of electricity for soil sterilisation varies between 1 to 1½ kWh per cu. ft. of soil sterilised, the time taken being about one hour.

The lethal temperature for fungi, pests and weed seeds lies below 160 deg. F., and at temperatures in excess of 200 deg. the nitrifying bacteria which assist plant growth are largely destroyed. For this reason soil which has been sterilised with high pressure steam or by baking over coke furnaces usually requires leaving for a period before it can be used. In the electric soil pasteuriser the layer of soil nearest the electrode plates loses its moisture when the average temperature has reached 180 deg. F., and thus its electrical resistance is sufficiently increased to limit the heating current so that no further rise in temperature is possible unless additional moisture is added near the plates. This procedure may, however, be adopted when temperatures approximating 212 deg. F. are desired.



An electrically heated greenhouse by H. Church & Co.

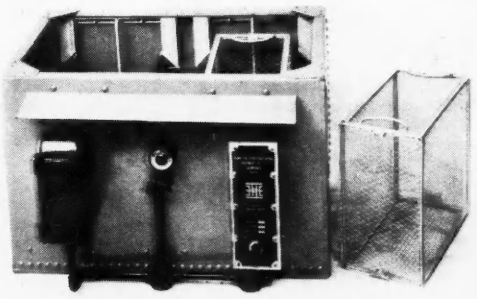
The pasteurisation of bulbs to rid them of eel worms, &c., calls for closer temperature control and even heat distribution. Two sizes are made by the Electro-Horticultural Co., the heating strip being well distributed around the sides and base, and deflection plates are provided to assist circulation of the water. The loadings are 1½ and 1¾ kW respectively at 12 V, a thermostat enabling the temperature to be set at any position between 108 and 115 deg. F. (±1 deg.). For distributing finely powdered insecticides the company is supplying an electric sprayer, while another new departure is its interest in "liquid culture," the principle of growing plants in heated nutrient solutions.

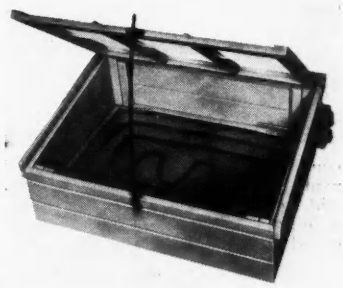


Tarpen hedge clipper and pruning saw

Lloyds & Co., Ltd., have added to the existing oscillating knife and rotary knife the "Hedgeshear" which is chain driven from a motor in the handle, and a new rotary pruning saw capable of cutting branches 1½ in. thick. Hedge-cutters and prunersare also made by the Tarpen Syndicate, while both concerns make small portable generating sets from which these appliances may be driven.

Electric greenhouse heaters are a speciality of H. Church & Co., Ltd. They state that an experimental greenhouse set to a minimum of 42 deg. in an exposed position and warmed with a 1-kW heater used an average 6.7 kWh daily from October to December and 8.7 kWh from October to March, while a frame (275 W), used for forcing bulbs later transferred to the greenhouse, took 2¾ kWh a day. These figures were for 1933-34; a similar greenhouse used only 5¼ kWh a day in 1935-36.





Left: A 100-gal. bulb pasteurising tank (Electro-Horticultural Co.) and (below) G.E.C. garden frame

For some considerable time the General Electric Co., Ltd., has carried out research in connection with soil heating by means of cables. It has now introduced a small garden frame heated on these lines. The heating is by cable mounted on a perforated galvanised iron sheet and control is effected by means of a switch and a thermostat with a range of 30 deg. to 100 deg. F.

This type of frame may be used for propagating seedlings or cuttings with gentle heat, starting early plants and vegetables in soil, as a frost-proof frame for over-wintering tender species, and for similar purposes. The ease with which the temperature can be varied enables plants to be started at a high temperature, and subsequently hardened off gradually without transplanting.

The "Dexter" pruning saw (Lloyds & Co., Ltd.)

The size is 36 in. wide, 2 ft. 8 in. deep, 1 ft. 3 in. high at the back and 9 in at the front, the loading being 125 W for 200/250 volts a.c. only.

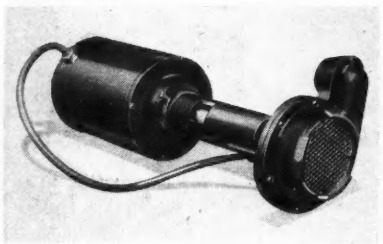
D

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An A.c. Suds Pump

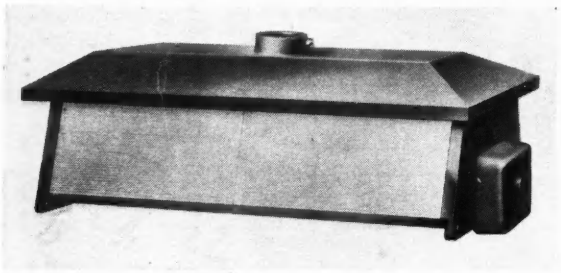
The electrically driven suds pump made by HORACE GREEN & CO., LTD., Cononley, Keighley, is not a mere adaptation of a standard small motor. This a.c., 50-cycle combination has been newly designed and is suitable for two- and three-phase supplies only. The motor itself is fitted with large bearings, and the employment of a thick shaft made of high-tensile steel avoids the necessity for providing a bearing at the bottom of the pump. The unit is highly standardised, all machined parts being made to close limits and all holes are jig-drilled. The driving motor is totally enclosed and waterproof (though not suitable for submersion) and is guaranteed to comply in all respects with B.S.S. No. 170-1926. The pump is manufactured in two sizes, capable of outputs of 10 and 20 gal. at a 13 ft. head.



The Green suds pump

A Double-panel Sodium Lantern

A double-panel lantern designed for use with 100- or 150-W sodium electric-discharge lamps is being introduced by HOLOPHANE, LTD., Elverton Street, Vincent Square, London, S.W.1. Easy maintenance is the predominant feature, the side panels being constructed of two prismatic plates, sealed together, giving a smooth exterior. The unit is designed to give an axial lighting distribution along the roadway and to ensure good visibility without glare. It has cast head and sides and the overall dimensions are approximately 2 ft. by 1 ft. by 1 ft.



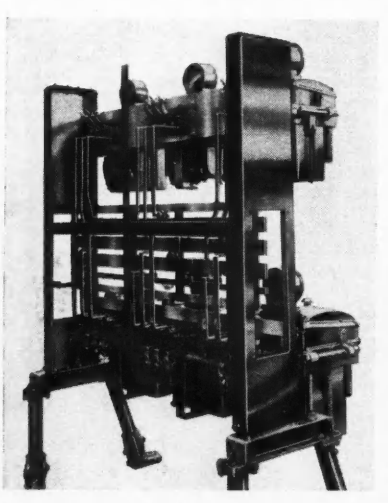
Holophane lantern for sodium electric-discharge lighting

Distribution Draw-out Switchgear

GEORGE ELLISON, LTD., Perry Barr, Birmingham, 20, inform us that their range of distribution draw-out switchgear, introduced a few years ago, has been improved and the range of sizes increased. It is now possible for breakers varying in capacity from 20 A to 4,000 A to be mounted together on one switchboard.

Special attention has been paid in this new design to the methods of connecting cables to the switchboards. All cover plates are removable so that cables can be "laid on" instead of having to be "poked" into position. There is ample space for connecting up. Cables can be led in either through the top or the bottom of the bus-bar chamber. The cable fittings may be either straight, to receive cables from above or directly below, or they may be curved to enable the cables to be brought in easy sweeps from floor level or from a cable trench. The cable armour is secured by Ellison cone glands and specially shaped connection clamps hold the cable tails securely without the use of solder.

As shown in the accompanying illustration, the redesigned tubular supporting stands of the unit leave a clear space underneath the bus-bar chambers for laying heavy cables from any direction, and the supports are sufficiently far apart to straddle the widest cable trench.



Ellison draw-out switchgear with the covers removed, and showing the widely spaced supporting stands

An Improved Vacuum Cleaner

BROWN BROS., LTD., Great Eastern Street, E.C.2, have introduced a new external bag type vacuum cleaner, the "Duco Major." Improvements incorporated include a high-speed motor; a motor-driven brush agitator; self-lubricating bearings; a streamlined nozzle adjustable to suit the pile of the carpet; enclosed adjustable wheels; swivel castors giving greater freedom of movement; furniture guard all round; an expanding bag mouth to facilitate emptying; fully insulated rubber grip handles; and built-in switch, flex and main plug. It has a loading of 300 W.

The attachments comprise a flexible extension tube, metal extension tube, crevice nozzle, carpet nozzle, triangular brush and extension adaptor.

The "Duco Major" cleaner

Distribution Pillars

BRITISH INSULATED CABLES, LTD., has recently introduced a new short-type tailless unit which will accommodate five-core cable for three-phase, four-wire distribution and street lighting. The new unit can be used in most existing pillars originally designed to accommodate units for three-core cables.

In accordance with B.I. standard practice, all current carrying parts are made from hard drawn h.c. copper and the unit will take either high-rupturing-capacity fuses or links.

Another recent development is the B.I. dwarf-type pillar which has been designed to occupy the smallest possible space and so minimise the obstruction of footways. These pillars are adapted for erection against walls or for building into them. The pillar opens only at the front and the units are of the tail type, consisting of cable and bus-bar fittings in extruded copper mounted on a robust insulating bar and accommodating high-rupturing capacity fuses or links. The insulating bars are rigidly fixed to iron brackets in the pillar carcase.

A B.I. dwarf pillar and a short-type tailless unit

The incoming multi-core cables are sealed in angle-type terminal boxes mounted in the base of the pillar, and v.i.r. or similar insulated tails are taken therefrom to the fuses or links.

The range consists of four- or six-way pillars suitable for four- or five-core cable, 150 or 300 A. The largest of the series is only 3 ft. 6 in. high from ground level, 2 ft. 8 in. wide and 9¾ in. deep.

Electricity Supply in France

Predominance of water power

THE official statistics relating to the generation and distribution of electricity in France, issued by the French Ministry of Public Works, are published every other year in an abbreviated form. The latest returns* relate to the year 1935 and omit certain of the detailed statistics for hydro-electric plants, storages and thermal power stations, the 1936 figures for which will be published early next year. In the meantime, it seems that there has again been a substantial increase in the installed capacity of hydro-electric stations the total now amounting to 3,745,238 kVA, compared with 3,321,662 kVA in 1934, an increase of about 11.2 per cent. On the other hand, the installed capacity of thermal power stations has remained practically stationary at 7,100,000 kVA.

The total energy generated during 1935 amounted to about 15,818 million kWh, about 51.5 per cent. from hydro-electric and 48.5 per cent. from thermal power stations; this compares with 15,172 million kWh in 1934, about 47.5 per cent. from water power and 52.5 per cent. from fuel-burning stations. The change-over to predominance of hydro-electric generation is significant, and it seems certain that there will be further developments in this direction, particularly as the "normally available power" of the hydro-electric stations rose from 1,362,113 kW in 1934 to 1,465,590 kW in 1935, whereas that of the thermal stations fell from 5,132,428 kW to 5,069,580 kW. The data in Table 1 compare the installed capacity and generated kWh of stations, classified according to their principal object, for the years 1934 and 1935.

TABLE 1.—INSTALLED CAPACITY AND OUTPUT OF FRENCH POWER STATIONS.

Main Object.	Year.	Thermal Stations.		Hydro-electric Stations.	
		Installed kVA.	Million kWh.	Installed kVA.	Million kWh.
Distribution	1935	2,719,296	1,919.7	1,179,336	2,674.2
	1934	2,787,915	2,012.4	1,078,511	2,296.3
Generation	1935	1,996,901	2,018.1	1,508,338	3,205.9
	1934	2,036,664	2,327.0	1,337,348	2,720.8
Electro-chemistry or metallurgy ...	1935	9,000	1.4	641,731	1,660.2
	1934	9,000	1.2	578,802	1,452.5
Mining	1935	1,520,040	2,139.2	19,925	31.7
	1934	1,467,520	2,179.1	53,333	155.4
Metallurgy	1935	681,737	1,285.8	9,005	10.1
	1934	722,252	1,397.0	16,205	36.3
Others...	1935	174,287	290.1	386,903	581.2
	1934	74,205	60.7	257,463	533.8
Total	1935	7,101,261	7,654.2	3,745,238	8,163.4
	1934	7,097,556	7,977.2	3,321,662	7,195.2

The consumption of coal (excluding lignite) in stations of 1,000 kVA or greater installed capacity, operated primarily for the distribution or bulk generation of electricity, decreased from an average of 0.707 kg. (1.56 lb.) on an output of 4,149 million kWh in 1934, to 0.693 kg. (1.53 lb.) on an output of 3,778 million kWh in 1935, the proportion of imported coal burned falling from 11.5 per cent. in 1934 to 7.67 per cent. in 1935. These figures relate to only a part of the total output of thermal stations but are, in themselves, comparable. About 85.9 per cent. of the total output of thermal stations in 1935 (84.6 per cent. in 1934) was from coal, and 9.3 per cent. (compared with 10.3 per cent.) from blast furnace gas; the output from pulverised coal fell from 33.9 per cent. of the total in 1934 to 32.6 per cent. in 1935.

The lengths of distribution lines in various categories are

TABLE 2.—LENGTHS OF DISTRIBUTION LINES.

Current and Voltage.	Year 1935.	Year 1934.
	Miles.	Miles.
D.C., not over 600 V	3,123	3,160
A.C., not over 150 V	100,218	94,776
A.C., 150–250 V	62,635	54,564
H.V., below 60 kV D.C. or 33 kV A.C.*	140,683	134,581
E.H.V., at least 60 kV D.C. or 33 kV A.C.* ...	10,953	10,169

* Between conductor and earth.

compared in Table 2, showing a substantial advance in a.c. distribution. Out of a total of 9,425 million kWh distributed by these lines in 1935, about 6,559 million kWh was taken at high voltage and 2,866 million kWh by low-voltage power, lighting and domestic consumers. Towns of over 40,000 population took about 1,830 million kWh at high voltage, and 1,469 million kWh at low voltage, the average of 292 kWh per capita being made up by 162 kWh at high-voltage, 92 kWh for lighting and domestic uses, and 38 kWh for low-voltage power applications. The average per capita consumption for the whole country is substantially higher than in this group of 57 towns and cities.

The total length of transmission and distribution lines was about 317,611 miles, about 14 per cent. greater than in 1933 (the figure for 1934 is not available), the increase being almost entirely in overhead lines, which accounted for about 95 per cent. of the total mileage in 1935. The total energy distributed to consumers is given as 9,425.2 million kWh in 1935, the number of networks distributing over 100 million kWh being 29 (31 in 1934); from 50 to 100 million kWh 25 (18); from 20 to 50 million kWh 42 (46); from 10 to 20 million kWh 37 (38); and less than 10 million kWh 1,559 (1,653); total 1,692 (1,786). The reason for the reduction in the total number of networks is not stated, but may lie in the interconnection of networks which were formerly distinct.

The total electrical energy generated in 1935 was 15,818 million kWh to which must be added a net import of 469 million kWh, making available 16,287 million kWh, of which 2,859 million kWh, or about 17½ per cent. was lost in conductors and transformers, and 13,428 million kWh was consumed as shown in Table 3, compared with 1934 and the peak year 1930. The distribution of this consumption between various uses is shown in Table 4.

TABLE 3.—CONSUMPTION OF ELECTRICAL ENERGY.

	Year.		
	1935.	1934.	1930 (peak).
Consumption, in million kWh :—			
Electrochemical	2,240	2,188	2,934
Other uses :			
Through distribution networks	8,242	8,270	7,806
Without distribution networks	2,946	2,531	2,895
Total, in million kWh	13,428	12,989	13,635
Average consumption kWh per head of population	320	309	327

TABLE 4.—ANALYSIS OF CONSUMPTION.

	Million kWh.	Per cent. of total.
High Voltage :—		
Traction	959.1	7.1
Electro-chemistry and metallurgy	2,240.1	16.7
Other uses	7,362.9	54.9
Total	10,562.1	78.7
Low Voltage :—		
Lighting and domestic uses	1,904.4	14.2
Power	961.7	7.1
Total	2,866.1	21.3

The total population is given as 41,840,000 and there were 10,337,735 low-voltage consumers, compared with 9,871,919 in 1934, an increase of about 5 per cent. for the year. Steady progress has been made in reducing the number of communes with no electrical distribution. On January 1st, 1934, there were 3,362 such communes (1,230,996 population); on January 1st, 1935, there were 2,635 (population 936,264); and on January 1st, 1936, the number had been further reduced to 2,236 (population 754,947), a reduction of 40 per cent. in population without electricity.

* "Statistique de la Production et de la Distribution de l'Energie Electrique en France pour l'année 1935." Pp. 23. Paris: Imprimerie Nationale (1937).

Conference on Magnetism

A conference on magnetism was held in the Physics Department of the University of Manchester on July 1st and 2nd under the auspices of the Manchester and District Branch of the Institute of Physics. Prof. W. L. Bragg, chairman of the branch, presided over the conference and lectures were delivered by Mr. G. Richer on "Electrical Sheet Steel"; Mr. D. A. Oliver on "Permanent Magnets"; Prof. N. F. Mott on "The Electron Theory of Metals and its Application to Magnetism"; Dr. C. Dannatt on "Influence of the Properties of Available Magnetic Materials on Engineering Designs"; Dr. E. C. Stoner on "Magnetisation Curves of Ferromagnetics"; and Dr. A. J. Bradley on "X-Ray Studies on Permanent Magnets of Iron, Nickel an Aluminium."

The Electrical Association for Women

A series of four public-speaking classes was held at the Headquarters of the E.A.W. during the London Branch Summer Session. The course consisted of two lectures, given by Mrs. Pender Chalmers, art lighting adviser to the B.T.H. Co., Ltd., and Mr. Stanley Hughes, lecturer at the City Literary Institute, and two practice classes, in the course of which many members gave short speeches.

Over fifty members of the London Branch availed themselves of an invitation by Mr. H. H. Berry, of Berry's Electric, Ltd., to visit his all-electric house, "Chauntry Court," at Maidenhead, recently.

New Books

Classified Examples in Electrical Engineering—Vol. II, Alternating Current. By S. GORDON MONK. (Fourth edition.) Pp. 167; figs. London: Sir Isaac Pitman & Sons. Price 4s.

In this edition of the author's examples in "heavy" electrical engineering, first published in 1928, some problems have been removed and a considerable number of more recent examples added. While some sections of the book are little altered, others are almost entirely new. The price of the book has been increased from 3s. 6d.

The questions are nearly all taken from public examinations, the date and origin of each being given. It may be questioned whether such a method of selection can cover a sufficiently wide range of examples for a book of this kind, although it has an advantage for the private student, while the "descriptive" questions bring out useful points in the preparation for examinations. Such general questions are, however, of limited value if the book is to be used in a tutorial class.

The problems are divided into fifty-nine sections. Although the difficulties introduced by a rigid classification in a work of this sort are obvious, the author has taken advantage of the sectionalisation to give a brief outline of the basic principles and theories underlying each section. Possibly of even greater value are the several references at the head of each section to an up-to-date and extensive bibliography. Reference is also made in certain advanced sections to published papers.

Answers are given to all numerical questions, and solutions of certain examples involving particular difficulty or interest are given in full. These solutions will be much appreciated by private readers; they indicate much painstaking on the part of the author, and the student should try to emulate him before resorting to the proffered aid.

Motor and Control Applications. By G. H. HALL. Pp. 259; figs. 167. London: McGraw Hill Publishing Co. Price 18s.

This is a practical and sensible book dealing with the characteristics of all types of electric motors and with the methods of controlling them and coupling them to the machines which they are intended to drive. The author has written for the needs of the power user and the works engineer, and he has confined himself to descriptive treatment of practical matters. Thus, the theory in the book is of the most elementary character, and little attention is paid to details of motor design. Not only will this book be of service to the power-plant engineer as a work of reference, but it will be read with interest and profit by the student as a supplementary volume to the more theoretical treatises.

In a short opening chapter the author deals with the determination of the characteristics of a motor required for stipulated duty as regards rating, starting, and speed regulation. Subsequent chapters deal descriptively with the operating characteristics of all types of a.c. and d.c. motors, and with both manual and automatic control gear used in connection therewith. Chapters of special interest are those in which are described motors for noiseless operation and for circumstances involving abnormal fire hazard, and with high-frequency induction motors. Two important chapters are those dealing with speed-reduction gearing and with external drives. In the final section of the work the requirements of various classes of machines are considered in detail and the type of motor and control gear suitable for each is explained.

The book is of American origin and the classification and terminology of the motors mentioned are based upon the N.E.M.A. Standards, which are fully set out in the final chapter. This will slightly, but only slightly, decrease the value of the book to English readers.

Handbook for Electric Welders. By J. H. PATERSON. Pp. 187; figs. 97. London: Murex Welding Processes, Ltd. Price 3s.

The new edition (the sixth in a little over five years) of this work has been enlarged by nearly 25 per cent., and has been modified in several instances in order to bring it into line with the most up-to-date practice. Without attempting to give detailed elementary instruction, it forms a useful guide to those wishing to gain a clear insight into various applications of arc welding. A short bibliography at the end of most chapters indicates books that go more deeply into physics and metallurgy.

The first chapter of the last edition, which dealt with elementary questions relating to the supply of electricity, has been replaced by a longer one on the general principles of arc welding that will probably be of more practical utility. The chapter on the strength of welded joints has been entirely rewritten, and various other revisions have been made.

Frank Broadbent

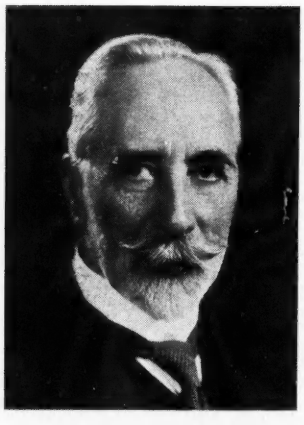
MR. FRANK BROADBENT, M.I.E.E., recently retired from the staff of the B.E.A.M.A. after serving that Association for twenty-two years. He entered upon a "temporary" period with the Association in 1915, but remained until June 30th, 1937. By temperament, education and training, as well as by technical experience, he proved his fitness for the many tasks that fell to him as secretary to thirty committees, and it was a happy inspiration which brought together at the Connaught Rooms on Wednesday last week a small gathering of his fellow members of the staff, some of the chairmen or vice-chairmen of sections which he had served, and a few personal friends and admirers, to give him a suitable "send-off."

Mr. V. Watlington, Director of the B.E.A.M.A., was in the chair, and after luncheon had been served he spoke appropriately and felicitiously of the great value of the varied service which Mr. Broadbent had rendered to the electrical industry as a whole by his hard work so tactfully done. On behalf of the senior members of the staff and representatives of his particular sections, Mr. Watlington asked their guest's acceptance of a presentation which may perchance stimulate in him a wish still to listen in to some familiar Kingsway voices.

In a charming reply Mr. Broadbent paid high tribute to the members of committees who had self-sacrificingly devoted long hours and special knowledge to the multitudinous subjects which had been brought before them. With a mind as alert as ever, he gave us a modest but humorous volume of happy reminiscences, citing, in the course of his remarks, experiences evidencing the very human element which again and again had found expression in what might otherwise have been merely frigid or controversial proceedings. It was an insight into the B.E.A.M.A. internal affairs which speaks well for those in control.

To the great majority of our readers the work of Mr. Broadbent, like that of many other men who are engaged quietly behind the industry, may be unknown, but it will be many years before it is forgotten among B.E.A.M.A. members. He was well-known to readers of the ELECTRICAL REVIEW for many years before he began his work at Kingsway, for he was one of our most highly appreciated contributors and friends.

To thousands of electrical installation men his book for "Dynamo and Motor Attendants" has been of great assistance, while young hopefuls, and some older ones as well, have read his "Chats on Electricity" with keen interest. Of the former book some 50,000 copies were sold and it is now out of print; it ran through ten editions.



[Elliott & Fry
Mr. Frank Broadbent

Mr. Broadbent was born in 1867 at Ashton-under-Lyne, the son of a solicitor under whom he studied law for a time, and from whom he received a legal mind enabling him to grasp both sides of a matter (how valuable an asset in some committee work!). Electrical training began at Owens College, Manchester, and continued at the Hanover Square School and Finsbury Technical College. The year 1885 found him at Woodhouse and Rawson's; 1887 with Spagnoletti & Crookes; and in 1889 he went to J. H. Holmes & Co. at Newcastle-on-Tyne, as their chief superintending engineer. During these years he was bringing his ingenuity to bear in the direction of improvements in various electrical devices; the lighting of railway stations in London, the lighting of hundreds of steamships, &c., in the North, factory and works installations elsewhere and the electrical equipment of printing works—these and many other things combined to fit him for consulting engineering partnership with H. D. Wilkinson, a Hanover Square tutor of his early days, who did much submarine telegraph work while Broadbent specialised largely in industrial electrification, including the driving of printing works for some of the best known publishers and printers, always effecting a saving in the power bill.

The consulting engineering practice fell into suspense when he joined the B.E.A.M.A. at the suggestion of the late Mr. Dunlop, who asked him to deal with all standardisation matters. How that work grew and committees increased with its growth, is a story too long to tell here now, as is also that of the part that he played in organising the overseas branches as well as in guiding the operations of the Traffic Committee, and effecting large savings annually for members. Mr. Broadbent himself will long remember that the outstanding feature of all his committees was the remarkable spirit of good fellowship and co-operation to which he attributes the splendid results that have been achieved. B.E.A.M.A. is staffed by a number of very highly qualified and experienced, unobtrusive men, whose valuable service is in no way belittled by these references to the work of one of their number.

A. H. B.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Passport Concession for B.I.F.

The Department of Overseas Trade announces that free passport visas will be given to foreign buyers visiting next year's British Industries Fair, and also to their wives and children under eighteen years of age. The visas, which can be had on application to the nearest British Consular Officer, are valid for three months from the date of issue.

Electricity and Gas Showrooms at Bolton

Joint electricity and gas showrooms were suggested at the last meeting of the Bolton Town Council. Coun. Jones asked for an assurance that the chairman of the Electricity Committee would consult with the members of the Gas Committee on the provision of a joint showroom for the two departments. It appeared to him that the two committees were poles apart. Instead of competition, there should be closer collaboration by setting up a committee of lighting, heating and power. Coun. Cheadle said it would be convenient to have showrooms for both electricity and gas in one building, and he suggested, from a business and economic point of view, that this was an opportune time for development by erecting one building to be allocated to the Gas and Electricity Departments. Ald. Entwistle, chairman of the Electricity Committee, said that there was no objection to the Gas Department erecting showrooms adjoining the Electricity Department.

European Lamp Syndicate

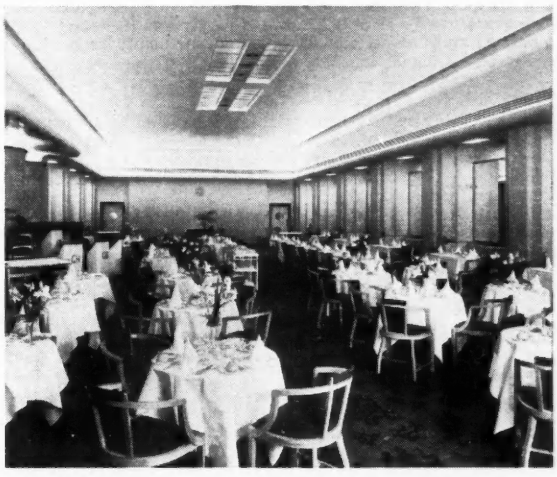
It is announced that the Kooperativa Luma Forbund, which was established in Sweden in 1928 by the co-operative societies in Sweden, Norway, Denmark and Finland for the manufacture of lamps for these organisations, has now become a member of the European Glow Lamp Cartel, which is embodied in the Phœbus Company, of Geneva.

A Long-service Dynamo

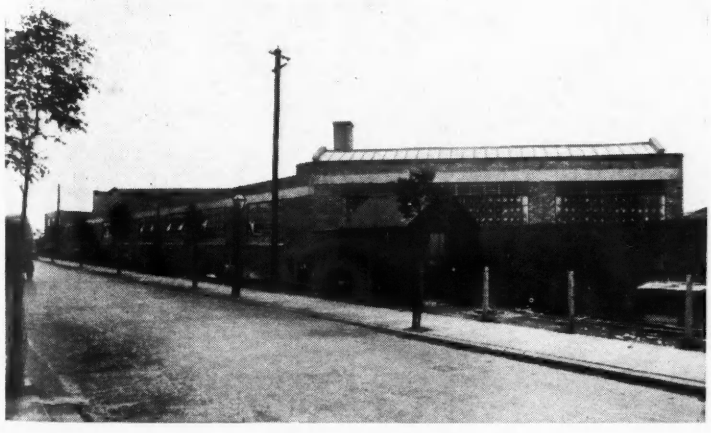
Crompton, Parkinson, Ltd., have sent us a photograph of a Crompton dynamo which, although over forty years old, is still giving twenty-four hours a day service for four months of the year and twelve hours a day for one month in a Burmese rice mill, where it is used for lighting a compound on a load of 80-90 A. Now obsolete, this machine of 110 V, 109 A, 1,190 r.p.m. is soon to be transferred to the local university.

Restaurant Lighting

The restaurant of the Grand Hotel, Sheffield, has recently been reconstructed and particular attention has been paid to the lighting installation, which the architects (Hadfield and Cawkwell) decided should be designed as part of the decorative scheme. The installation, which has been planned by G.V.D. Illuminators, Ltd., consists of a combination of direct and indirect lighting. Concealed cornice lighting is provided by special reflectors housed in a cornice (designed to the requirements of G.V.D. Illuminators), at a suitable height round the walls of the restaurant and in the bandstand, while alcoves containing seats are illuminated by glass panels inserted flush with the ceiling. In the centre of the restaurant a laylight approximately 20 ft. by 5 ft. has been installed. Opaque panels in this laylight not only conceal the principal light sources—which provide for full colour changes—from direct view, but contain specially designed spotlights for projecting colour lighting on the dancers or cabaret below. These spotlights are so devised that almost any combination of colours, or one colour only, can be projected without in any way affecting the main lighting from the laylight. In the cornice one 40-W lamp is used at every 2 ft. 6 in., there being altogether ninety-four in the main cornice and bandstand. In the laylight there are sixteen 100-W lamps, four of each colour, with special provision for the spotlights. G.V.D. Illuminators were also responsible for the lighting of the basement cocktail bar.



The restaurant of the Grand Hotel, Sheffield



An exterior view of the latest addition to the works of Switchgear & Cowans, Ltd., at Old Trafford

Electrical Factory Inspectors

In the House of Commons on Thursday last week Mr. Kelly asked the Home Secretary (Sir Samuel Hoare) whether he was aware that at a recent inquest on a man who was killed while testing a switchboard it was revealed that there were only five electrical factory inspectors for the whole country; and whether it was proposed to augment this number.

Sir S. Hoare said that there were nine electrical inspectors working under H.M. Senior Electrical Inspector of Factories, and the inspection of electrical apparatus in factories also formed part of the duties of the general staff of factory inspectors. The strength of the inspectorate would be reviewed in the light of the provisions of the Factories Bill as finally settled.

Switchgear Factory Extensions

Further extensions of the Old Trafford works of Switchgear and Cowans, Ltd., are now nearing completion. This is the third year in succession that the growing business in S. & C. switchgear has necessitated additions being made to the factory.

Equipment for India

Mr. S. N. Khettry, merchant, importer and commission agent, 11, Shambhomallick Lane, Calcutta, tells us that he is desirous of getting into touch with manufacturers and shippers of such equipment as switches, holders, wires, lamps, motors and fans, who are not already represented in India.

A Battery Factory for South Wales

The manufacture of all types of electric storage batteries is to be carried out by a syndicate of Cardiff business men, who have ordered a 5,000-sq. ft. factory at the Government-aided Treforest Trading Estate. The new company is to receive a loan from the Special Areas Reconstruction Association, following satisfactory tests of its batteries (this will be the first new company in South Wales to receive such help) and it is hoped that within twelve months at least a hundred people from the Special Area will be employed. The name of the company has not yet been decided on, but it is expected that production will start in about six weeks' time. It is stated that Mr. W. Bunip, a Cardiff consulting engineer, who has had considerable experience of electric storage battery production in America, will be the general manager.

Annual Holidays

The works of A. P. Lundberg & Sons, Ltd., will close down on Friday, July 30th, until Monday, August 9th, for the annual holidays.

Czechoslovakian Electrical Imports

According to the *Board of Trade Journal* imports of electrical machinery and apparatus into Czechoslovakia amounted in May to 18,437,000 cr. in value, making 81,307,000 cr. for the first five months of 1937, as against 50,695,000 cr. for January-May, 1936.

Junior Mines Inspectors

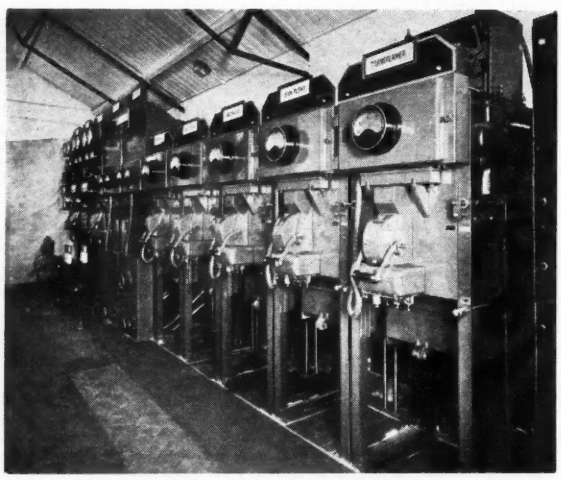
Captain Crookshank, Secretary for Mines, announces that he has decided to create sixteen additional posts in the Mines Inspectorate and to fill these posts by the appointment of Junior Inspectors in so far as suitable candidates present themselves. A competitive examination will accordingly be held, and he now invites applications for nomination to sit for this examination. Forms of application and full particulars of these posts can be obtained from the Under Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, Millbank, London, S.W.1.

Pension Schemes

In the Chancery Division on July 5, Mr. Justice Crossman heard and granted petitions by the Automatic Telephone & Electric Co., Ltd., Telephone & Associated Services, Ltd., and Telephone & General Trust, Ltd., for confirmation of resolutions for alteration and extension of the objects of the companies in connection with pension and superannuation schemes.

Switchgear for a Pipe Foundry

As a direct result of the increased demand for its products the Stanton Ironworks Co., Ltd., has installed a 10-panel "M.C.A.2" switchboard supplied by Crompton Parkinson, Ltd. With a rated rupturing capacity of 100,000 kVA and working on a system of 3,300 V, three-phase, 50 cycles, this



A 10-panel Crompton switchboard recently installed at the Stanton Ironworks

switchboard replaces a fixed cubicle type which was found to have an insufficient margin to cope with the possible maximum short-circuit kVA. The Stanton Ironworks, which has been in operation since about 1788, is probably the largest pipe foundry in the world and now employs over 14,000 persons.

Sussex County Show

The Ringmer and District Electricity Co., Ltd., was responsible for staging the electricity demonstration marquee in addition to giving a supply of electricity at the recent Sussex County Show. A special effort was made to convey to the public an idea of the varied uses of electricity. Cooking demonstrations were continuous, and the staff and guests dined upon the produce of the kitchens. For farmers there were among other exhibits a skid motor for transportation to any part of the farm and coupled up with various machines, a sterilising chest of special interest to producers of "accredited" milk, chaff cutters, pumps, &c. Johnson & Phillips, Ltd., supplied one of their animated displays of "Charlton" electric water heaters. The demonstrations were under the supervision of Mr. G. R. Lincoln, engineer and manager to the Ringmer and District Electricity Co., Ltd.

Kettering Hospital Carnival

We have received from Mr. W. A. Walker, electrical engineer and manager of the Kettering Urban District Council Electricity Department, a photograph of the Department's entry in the recent local hospital carnival parade. The tableau was based on the well-known advertisement, "There are many ways of cooking, but——," and compared in a humorous way the cannibal and the modern methods of cooking.

Prices of Materials

Henry Gardner & Co., Ltd., report, July 7th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £26 5s., £1 inc. Spelter, £22 10s., £1 inc. English block tin, £261, £7 10s. inc.

Frederick Smith & Co. report, July 7th: Electrolytic copper bars, £64, £2 inc. Ditto, ditto, wire rods, £69, £2 inc. Ditto, ditto, h.c. wire, 9½d., ¼d. inc. Silicium bronze wire, 10½d., $\frac{3}{16}$d. inc.

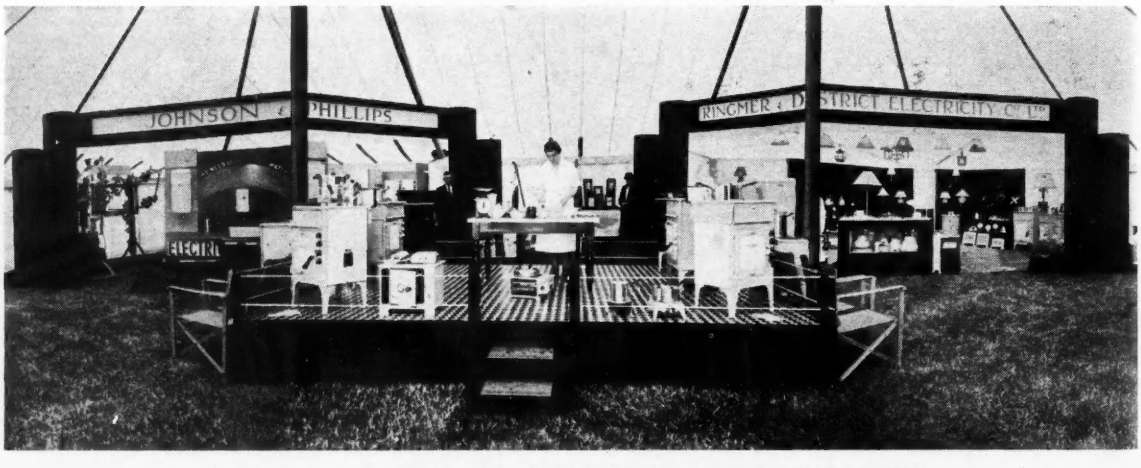
Edward Till & Co. report, July 7th: No change in the price of India rubber, Para fine.

Social Events

The annual sports of Johnson & Phillips, Ltd., were held on Saturday last at the company's sports ground, Kidbrooke. Mr. W. F. Smith, the hon. secretary of the J. & P. Sports Club, and his committee had organised an interesting programme, and good running and close finishes were the order of the day. Mr. G. Leslie Wates, the chairman of the company, was unable to attend, but Sir Philip and Lady Dawson, Mr. and Mrs. H. J. Sheppard, Mr. and Mrs. Charles Stewart, together with all departmental and many branch managers attended. Mr. W. Burge, the chairman of the Club, welcomed the directors, and thanked Lady Dawson for presenting the prizes.

A record attendance and entries, with perfect weather conditions, marked Henley's (Gravesend) Sports Club's annual sports and children's gala at the company's sports ground, Craggs Farm, Singlewell, on July 3rd. The events were watched by Sir Montague Hughman, Mr. W. F. Bishop, Sir Maurice Simpson, Mr. and Mrs. J. Lamont, Dr. P. Dunsheath, Mr. A. H. M. Jacob, Mr. and Mrs. E. E. Judge, Mr. and Mrs. W. C. Barry and Mr. R. O. Wright, with a number of departmental chiefs. Head Office won the W. F. Bishop relay cup and the Head Office ladies' team was successful in the Lady Hughman challenge bowl relay. During the afternoon Sir Montague Hughman bowled the first "wood" and formally handed over to Henley's (Gravesend) Bowling Club the new bowling green, a centenary gift to the Sports Club from the board. He was presented with a silver jack, suitably inscribed, by the Sports Club. The afternoon's events included races and a tea for the children, baby show, side shows and amusements. Mrs. W. F. Bishop distributed the prizes, and the function was concluded with dancing in the pavilion.

The Callender Athletic Social Club held its annual sports meeting on June 26th. One of the attractions was the tug-of-war which was won by the R.A.S.C., Feltham, Army and A.A. champions and holders of the Sir Kingsley Wood Shield. At the end of the meeting the prizes were distributed by Mrs. T. O. Callender, among those present being Mr. T. O. Callender, Mr. and Mrs. C. Pipkin and Mr. J. Snow-Huddleston. Music was provided throughout the afternoon by Callender's Band.



The Ringmer and District Electricity Co.'s display at the recent Sussex County Show

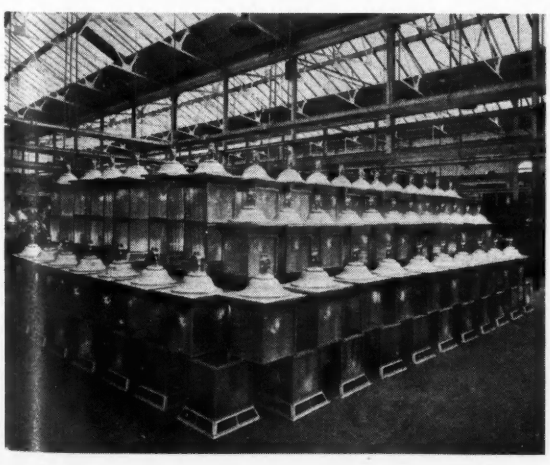
The Royal Show, Wolverhampton

The Royal Agricultural Society's Show which opened at Wrottesley Park, near Wolverhampton, on Tuesday last may be justly described as an all-electric show. Electrical cooking and water-heating plant to the value of about £3,000—the outcome of co-operation by manufacturers and supply undertakings—has been installed in the temporary miniature town erected on the 100-acre site. Among the exhibitors are some of the principal electrical apparatus and fittings manufacturers, and all point to the progress which has been made in the supply of farming equipment. The General Electric Co., Ltd., is showing a wide variety of applications of electricity on its stand, and a special feature is a section laid out as a model dairy which includes apparatus for the farmer to carry on his work in the most hygienic manner. The domestic service includes cookers, refrigerators and a representative range of household appliances. Ruston and Hornsby are also large exhibitors, and include all the makes of their engines. Other exhibitors of oil engines are Blackstone & Co. who are displaying on the stand of their associated company, R. A. Lister & Co., Ltd., while the exhibits of Petters, Ltd., include a 1-kW 100-V automatic lighting set. Messrs. Bulpitt & Co. are showing their latest appliances, and Messrs. Gascoigne (Reading), Ltd., are exhibiting equipment, including electrical milking machines. The Lightfoot Refrigeration Co., Ltd., has a special show of modern refrigerators, and another company specialising in the same kind of equipment is Kelvinator, Ltd. The Jackson Electric Stove Co. has on its stand much to interest the users of electricity in the way of household appliances, and another stand, that of the British Electrical Development Association, is very attractive to users of electricity in many ways. Revo Electric Co., Ltd., has a good selection of all its latest appliances, and the Metropolitan-Vickers Electrical Co. has also on view many of its products. The Electrical Horticultural Equipment Co., Ltd., has an interesting display of farming and gardening appliances, and Moffatts, Ltd., are showing cookers and refrigerators. W. H. Podmore, of Wolverhampton, exhibits B.T.H. refrigerators, together with water softeners, fountains, pumps and small generating sets. Birmingham Power Transmission, Ltd., is showing on its stand equipment for the erection of line shafting and also electric motors, lighting apparatus and many classes of machinery. To afford the necessary supplies the Electricity Department of the Wolverhampton Corporation has extended its 6,000-V overhead line and underground cable, and has provided nearly two miles of low-voltage distribution mains. In their task of supplying the public with meals the caterers have been supplied with six electrically equipped kitchens, and it is interesting to note that no fewer than seventy exhibitors are using electricity. Two other firms who are exhibiting appliances are the Hotpoint Electrical Appliance Co., Ltd., and the Electric Construction Co., Ltd. Brook Motors, Ltd., has a travelling showroom for displaying its products.

At the Farmers' Electrical Conference, which was to be held yesterday (Thursday), Mr. F. N. Slade was to read a paper on "Electricity and Marketing."

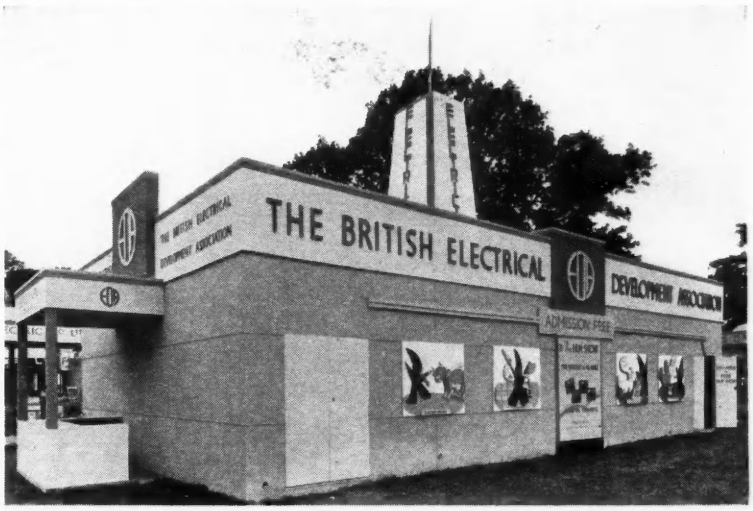
Orders Recently Booked

The accompanying illustration shows part of an order for 353 Revo type C.9018 lanterns ready for dispatch from the Revo Electric Co.'s works at Tipton, Staffs. A similar quantity of special Revo brackets is also under construction for the same order. The equipment is intended for use in the main streets of Port Elizabeth, South Africa, and it is claimed that when the installation is completed it will represent the largest mercury electric-discharge lighting scheme in South Africa. The Revo C.9018 lanterns comprise a substantial copper frame, surmounted by a heavy-gauge copper canopy and cast-iron dome.



Revo lanterns ready for dispatch to South Africa

The glass panels are of specially designed prismatic and lenticular formation which, in conjunction with the internal stainless steel reflectors, give the most advantageous distribution of the light output upon the carriageway. Each fititng is complete with Revo. C.9084 patent self-aligning condensation proof joint box and lampholder, the necessary choke coils and condensers and cast-iron weatherproof boxes to contain them.



The E.D.A. stand at the Royal Show

Old Iron

As a result of co-operation between scrap iron and steel merchants and steel makers measures are to be taken as from next week to collect larger quantities of "old iron" from households, farms, estates and works all over the country. An incalculable but certainly enormous tonnage of scrap is believed to be lying idle. At a time when steel outputs are exceeding all records it is considered to be highly desirable that this store of an essential raw material shall be regularly cleared. The public, manufacturers and traders will be asked in the national interest to raise the flow of scrap iron to steel works through the existing channels. The regular use of scrap in steel-making implies the conservation of invaluable coal and iron ore resources.

Trade Announcements

Mr. I. T. Watkins has been appointed to represent the Westinghouse Brake & Signal Co., Ltd., in the Midlands area. His address is 26, Featherstone Road, King's Heath, Birmingham (telephone: Highbury 3417).

To meet growing business J. Gerber & Co., Ltd., have moved to larger premises at 15, Moorfields, London, E.C.2 (telephone: Metropolitan 3381-2).

The Mitchell Electric Co., Meco Works, Five Ways, Birmingham, has taken over the electrical manufacturing department of Albert Phillips, Ltd., Eyre Street, Birmingham. The arrangement covers the whole range of the latter company's "Crescent" electric heating and domestic appliances, but will not interfere with the manufacture of the present products of the Mitchell Electric Co.

We are asked to state that the amalgamation arranged to take place between Cellomold, Ltd., and Rockhard Resins, Ltd., has no connection with Gittings & Hills, Ltd., sole manufacturers of the well-known range of "Rockhard" enamels and proprietors of the registered name "Rockhard."

New Catalogues and Lists

Crofts (Engineers), Ltd., Thornbury, Bradford.—A comprehensive illustrated catalogue S.137 in 21 sections (426 pp.) dealing with power transmission machinery and appliances, giving prices, dimensions, power outputs and other information relating to shafting, pulleys, collars, couplings, bearings, belts and ropes, gearing and geared motors.

Tricity Cookers, Ltd., Wellington House, 125, Strand, London, W.C.2.—Coloured folder illustrating and briefly describing the "777" cooker.

Turner's Asbestos Cement Co., Trafford Park, Manchester.—A well-illustrated brochure describing how asbestos cement is employed at the new Earl's Court Exhibition buildings.

J. Gerber & Co., Ltd., 15, Moorfields, London, E.C.2.—A catalogue of second-hand machinery covering electric motors, generators, convertors, motor generator sets, compressors, switchboards, batteries, transformers, starting gear, &c.

British Insulated Cables, Ltd., Prescot, Lancs.—Leaflet P.F.257, replacing P.F.173, dealing with "Thiokol" sheathing for rubber-insulated cables and wires.

Simplex Electric Co., Ltd., Broadwell Road, Oldbury, Birmingham.—Publications T.1607 and 1609, containing information and prices of conduits. Also a condensed price-list L.1608, describing lighting equipment for low-wattage electric discharge lamps.

British Oxygen Co., Ltd., Thames House, Millbank, Westminster, S.W.1.—A serviceable binder for holding the company's technical booklets.

A general view of the architectural section at the G.E.C. lighting fittings showroom at Magnet House, Kingsway, London

Knightshades, Ltd., Derby Road Works, Montagu Road, Edmonton, London, N.18.—Examples of the latest types of fittings, pendant, table and standard, in various attractive materials, are illustrated in colour in the new season's 50-page catalogue.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—"G.E.C. Street Lighting with Osira Lamps," a 24-page illustrated brochure, has been prepared expressly to help non-technical persons in their deliberations on specific schemes. Booklet, illustrated in colours, containing prices and descriptions of the new season's range of radio receivers, radiograms and loud speakers.

British Klöckner Switchgear, Ltd., 21, Richmond Place, Wandsworth Road, London, S.W.8.—A catalogue of switchgear and control gear (in German).

Gent & Co., Ltd., Faraday Works, Leicester.—Catalogue No. 1H (pp. 82), dealing with bells, indicators, relays, pushes, and audible and visible signal systems.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—A leaflet describing "Sieray Q.H." high-pressure mercury lamps.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.—A leaflet on vice-type line connectors.

Bankruptcy Proceedings

L. Smethurst, 155, Footscray Road, Eltham, S.E.9, lately 17, Hanover Buildings, Southampton, and 277, Shirley Road, Southampton, electrical and radio engineer.—The public examination was held recently at the Court House, Greenwich. The statement of affairs filed showed ranking liabilities of £1,526, with net assets of £22, leaving a deficiency of £1,504. Debtor said that in August, 1930, he promoted a limited company with a nominal capital of £5,000, with the object of taking over his business. Eventually, however, that company ceased to trade. Debtor purchased certain office furniture, fittings and a motor car, and started a similar business at the same address with borrowed money. Finally, owing to difficulties, he filed his petition. The examination was adjourned for closing.

G. W. Linsell, radio and electrical dealer, Tippendale Lane, Park Street, near St. Albans, Hertfordshire, lately carrying on business at 26, London Road, St. Albans.—This debtor's public examination was held recently at the Court House, St. Albans, and adjourned.

E. Weston, electrical and radio dealer, trading as the Weston Electrical Contracts Co., 41, Upper Marylebone Street, London.—Receiving order made June 24th on a creditor's petition. First meeting held July 7th. Public examination August 24th at Carey Street, W.C.2.

T. B. Brown (Brown & Senior), wireless and electrical engineer, 199, Slaithwaite Road, Dewsbury.—Trustee, Mr. W. F. Cresswell, 71, Manningham Lane, Bradford, Official Receiver, released June 10th.

J. R. Brightwell, electrical contractor, trading as R. Brightwell, 107, Queen's Road, London, W.2.—Application for discharge to be held on July 21st at Carey Street, W.C.2.

S. D. Bennett, electrical engineer, 2, Burnt Ash Parade, Lee.—Receiving order made June 25th on debtor's own petition

Company Liquidations

Southern Globe Electrical Co., Ltd., 52, Minster Street, Reading.—The statutory first meeting of the creditors was held recently at the Official Receiver's office, 8, Forbury, Reading, when it was stated that the winding-up order was made against the company on April 12th last year. The creditors passed a resolution for the appointment of the Official Receiver as liquidator.

Ready Radio, Ltd., "Eastnor House," Blackheath, London, S.E.3.—Claims by July 13th to the liquidator, Mr. S. K. Tubbs, 24, Basinghall Street, London, E.C.2.

Durham and District Electric Traction Co., Ltd.—Members' voluntary winding-up. Joint liquidators, Messrs. T. Bower and H. G. W. Teverson, 88, Kingsway, W.C.2.

British Electrical & Engineering Co. of China, Ltd.—Particulars of claims by July 23rd to the liquidator, Mr. C. C. Baker, Spencer House, South Place, E.C.2.

Deed of Assignment

J. E. Pickthall and **J. H. Vickers,** trading as Pickthall & Vickers, electrical engineers, 13, Moss Lane, Manchester.—Particulars of claims by July 16th to Mr. H. S. Grant, 2, Cross Lane, Salford.

Dissolution of Partnership

Electrode Sign Co., 93, Button Lane, Sheffield.—Messrs. R. Vernon and J. B. Thompson have dissolved partnership. Mr. Vernon will attend to debts and carry on the business.

Some of the electrical stands at the Royal Agricultural Society's Show, which is being held at Wolverhampton this week (See page 59) *[Elec. Rev. photo.*

Electricity Supply

Lighting, Domestic, Power

Ayrshire.—ELECTRICITY AND COUNTY DEVELOPMENT.—An indication of how Ayrshire could be further developed was made by Mr. J. McCosh, convener of the County Finance Committee, at a recent meeting of the County Council. Mr. McCosh thought that Ayrshire was capable of large development, and one thing that would help materially would be an immediate supply of cheap electricity throughout the county, including villages and farms. This, he considered, could be carried out economically and effectively by the County Council in co-operation with the Ayrshire Electricity Board putting forward a large scheme, the Government meeting the initial cost with a grant of at least 75 per cent.

Panoramic night view of Portsmouth. The bright street lighting is by "Osira" mercury electric-discharge lamps in G.E.C. lanterns, these being installed in most of the principal thoroughfares

Barking.—CHEAPER ELECTRICITY.—The Electricity Committee has reduced the lighting flat rate from 3½d. to 3d. per kWh, the prepayment lighting rate from 4½d. to 4d. per kWh, and the prepayment domestic rate from ¾d. to ⅝d. per kWh. In addition, the discount for payment of quarterly accounts within one month has been increased from 10 to 12½ per cent.

Barnstaple.—LOAN.—The Town Council has received sanction to a loan of £30,000 for mains, sub-station equipment, buildings and plant in connection with the conversion from d.c. to a.c. and extension of the supply area.

Bingley.—ANNUAL REPORT.—The chief electrical engineer and manager, Mr. O. G. Cook, in his 1936-37 report states that the Electricity Department experienced a successful year, the gross profit being £12,531 and the net profit £6,221.

DISCHARGE LIGHTING.—The Electricity Committee has accepted the recommendation of the chief electrical engineer and manager for approximately three miles of mercury electric-discharge lighting.

Birmingham.—ONE TARIFF THROUGHOUT AREA.—At Tuesday's meeting of the City Council Sir Percival Bower stated that the Electric Supply Committee would apply itself to working out a uniform tariff for electricity throughout the area of supply, and proposed to make further tariff reductions.

Blackburn.—EXTENSION.—A sum of £1,023 is to be spent in connection with the provision of a supply to the Atlas Foundry.

Brazil.—SUPPLY PROGRESS.—The report of the Brazilian Traction Light & Power Co., Ltd., for 1936, states that work progressed steadily during the year in connection with the Serra development, near San Paulo. The Rio Grande reservoir, which has been completed, has an area of 50 sq. miles. A 54,000-h.p. unit has been added to the Ilha dos Pombos plant on the Parahyba River. During the year the connected transformer capacity was increased by additions to the extent of 77,490 kVA, making the total 1,134,061 kVA. The overhead distribution network was extended by 1,206 miles, the total mileage at the end of the year being 23,528.

Brierley Hill.—IMPROVED LIGHTING.—The Urban District Council has adopted proposals for the re-organisation of street lighting in the district, with the provision of ninety-five additional electric lamps, at an increased cost of £380 per annum.

Czecho-slovakia.—ELECTRICITY UNDERTAKING AS STEAM SUPPLIER.—A feature of the operations of the Westmährischen Electricitatswerke Gesellschaft is that in addition to electricity it supplies large quantities of steam to the textile mills in West Moravia. Altogether, steam is now being supplied from the Brunn plant (one of two operated by the concern) to eighty-one consumers, an increase of eleven during the year, and as the demand is now rapidly reaching the maximum which can be supplied an extension of the steam-producing plant is under consideration.

Chester.—HIGH-VOLTAGE EXTENSION.—The Electricity Committee is providing a high-voltage main from Mill Lane to Kingsmead, Upton, together with a transformer kiosk.

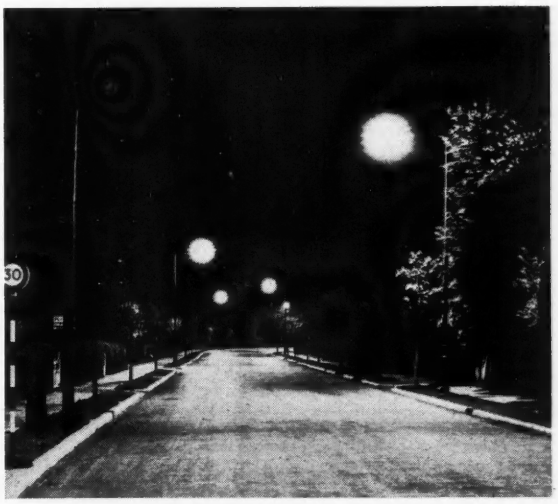
Douglas (I.o.M.).—NEW PLANT.—Extensions to cost £61,935 are to be carried out at the Douglas power station. They include the provision of a 40,000 lb. per hr. water-tube boiler with accessories, a cooling tower and concrete tank capable of dealing with 220,000 gal. per hr., extraction and circulation pumps, higher rupturing capacity switchgear and rectifying plant. At a Local Government Board inquiry held at Douglas, Mr. B. B. Kelly, the borough electrical engineer, said that at the present rate of progress further extensions would be required in 1942 or 1943.

Dundee.—RATE CONTRIBUTION CRITICISED.—The Finance Committee recently decided to create a precedent by transferring the surplus of £3,106 earned by the Electricity Department during the year to the general rate fund. The decision was criticised by members who described it as very bad finance. It was pointed out by the Lord Provost that the powers under which the treasurer was acting were acquired primarily for income-tax purposes, and it was never expected that a treasurer would apply the surplus from a trading department in such a way. A subsequent meeting of the Town Council, by a margin of two votes, approved the action of the Finance Committee.

Durham.—SCHOOL INSTALLATIONS.—Electricity is to be installed in the Dubmire Council, East Boldon, Hare Law, Houghton-le-Spring, New Seaham Low, Washington Colliery, and Westwood Council schools.

Eastbourne.—RURAL EXTENSIONS.—The Electricity Committee is seeking sanction to borrow £15,000 for extensions in the rural area.

Eccles.—WORKS SUPPLY.—It is reported that L. Gardner & Sons, Ltd., have accepted the standard terms offered by the Electricity Department in connection with a proposed extra high voltage supply to their Barton Hall engine works. The initial estimated annual consumption is one million kWh.



King's Drive, Eastbourne, which together with The Avenue, comprises a scheme in which eight-five Revo C.9325 sodium mirror reflector fittings have been used. The units are mounted 25 ft. high at intervals of 150 ft. on 12 ft. and 6 ft. extension brackets

Finchley.—LARGE WATER-HEATERS.—The borough electrical engineer recently reported that a number of inquiries had been received for 20-gal. water heaters, which size was not included in the hire scheme. The Electricity Committee gave authority for the purchase of such heaters when required, the hire charge being fixed at 10s. per quarter.

SPECIAL TARIFFS.—An alternative tariff for places of entertainment has been recommended. This comprises a fixed

charge of £6 10s. per annum per kW of maximum demand, with a "unit" charge of ½d. So far as business premises, places of worship, public halls, schools, libraries and hospitals are concerned, it is proposed to offer supplies for heating purposes at a flat rate of ½d. per kWh, subject to a restriction of supply between peak periods in the months of November, December, January and February (excluding Sundays) and to the consumer providing his own equipment.

COOKERS IN SCHOOLS.—Approval has been given to the installation, without charge to the Education Committee, of electric cookers in three elementary schools, and a similar arrangement in regard to the Woodhouse secondary school.

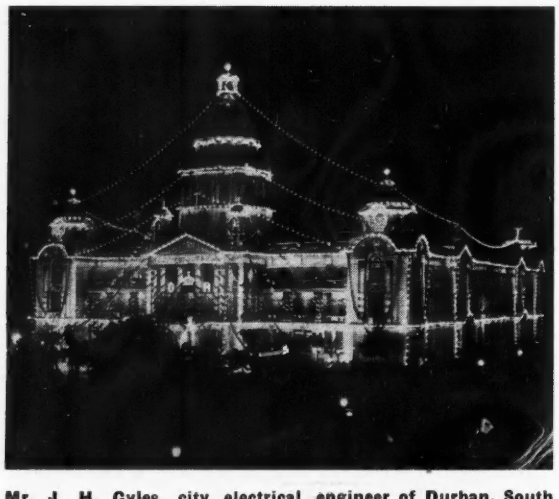
Kingston-upon-Thames.—ANNUAL REPORT.—The report of the borough electrical engineer (Mr. E. J. Jarvis) for 1936-37 states that sales of energy increased by 3.8 million kWh (21 per cent.), the average price being reduced from 1.28d. to 1.18d. There was a net profit of £1,179.

London.—FULHAM.—An alternative method of determining the price to be paid by the Council to the Central Electricity Board for local supplies is proposed. This will operate for four years, after which the Council will be able to change over to the station adjusted cost or to the grid tariff, or arrange a new figure with the Board.

The Electricity Committee has approved the following capital expenditure for the completion of the first section of the new power station :—Contracts still to be let, £36,000; excess expenditure on existing contracts, £70,000; general items additional to contracts already let, £30,000; additional equipment, £28,655.

SOUTHWARK.—The Electricity Committee is seeking sanction to borrow £12,000, which includes £8,000 for an extensive scheme of "free" wiring on the Pullen's estate.

WESTWAY'S NEW LIGHTING.—Westway, Hammersmith, which has been prominent recently on account of the numerous accidents which have occurred there, has been provided with a modern system of lighting by means of "Osira" high-pressure mercury electric-discharge lamps housed in G.E.C. "Difractor" lanterns. Forty units have been installed over a dis-



Mr. J. H. Gyles, city electrical engineer of Durban, South Africa, has sent us this view of the City Hall attractively illuminated for the Coronation

tance of some 1,600 yd. on tall steel columns placed in staggered formation at 120 ft. intervals along each side of the 40 ft. roadway. The lamps are suspended from 7 ft. 6 in. bracket arms projecting towards the centre of the road, the mounting height of the lanterns being 25 ft. above the road surface.

STEPNEY.—It is proposed to extend the Limehouse generating station by the installation of a 30,000-kW turbo-alternator and three 150,000-lb. per hr. boilers.

Macclesfield.—REFRIGERATORS.—The Electricity Company of Macclesfield, Ltd., is offering to supply refrigerators on five years' hire-purchase. Refrigerators of 3 cu. ft. are quoted at 3s. per week, and the 5 cu. ft. size at 3s. 9d. per week. For the convenience of householders who are not certain of the size of cabinet required and who prefer to try before they buy, the company is offering to let out on hire 2-, 3-, 4-, and 5-cu. ft. models on a yearly basis at rentals ranging from 1s. 4½d. to 3s. 5½d. per week.

Manchester.—LOWER CHARGES.—As briefly reported last week, the City Council is being recommended to approve substantial reductions in electricity charges, on the advice of Mr. H. C. Lamb, city electrical engineer and manager. This step is taken in the face of the rising price of coal and the loss to the Electricity Department of the Stretford bulk supply, amounting to 12 million kWh a year. The proposed reductions include ½d. per kWh off the first five steps of the sliding scale for lighting and 0.1d. off the sixth step. The kW demand charge of the combined lighting rate is to be reduced from £9 to £8 for demands from 20 to 50 kW and from £8 to £7 10s. over 50 kW. There are to be reductions of ½d. per kWh in the rates for domestic power and heat, small users of industrial power, cooking and heating on business premises, and miscellaneous users of small power. The power factor penalty for low-voltage supplies to small users is to be discontinued, while large users of industrial power under fuel clauses are to have a rebate of 2½ per cent. off the total charges. and power for hoists is to be reduced by ½d. per kWh. Hire charges will be reduced by from 6d. in the case of kettles to 3s. in the case of large cookers.

Newport (Mon).—ILLUMINATIONS.—Beantee Illuminations, Ltd., ask us to state with reference to a recent note that they supplied the strip lighting holders and cables for the Coronation illuminations at Newport as well as coloured lamps.

Newton Abbot.—VILLAGE ELECTRICITY SUPPLIES.—The Rural District Council is asking the Torquay Corporation to proceed with the provision of electricity supplies to Widecombe and Manaton.

Pinxton (Alfreton).—ELECTRIC LIGHTING SCHEME.—The Council is considering a scheme put forward by the Nottinghamshire and Derbyshire Electric Power Co. for the conversion of street lighting from gas to electricity.

Prestatyn.—LARGE NEON SIGN.—The chairman of the Electricity Committee has suggested the erection of a large neon sign on a high point near the town so that the name of the town may be seen thirty miles away.

Reigate.—MAINS.—The Town Council has received sanction to borrow £7,294 for mains, £2,500 for sub-stations and equipment, and £1,350 for transformers.

Sale.—REDUCED CHARGES.—A new scale of electricity charges beneficial to consumers has been introduced by the Council. The lighting rate, previously 4d. per kWh, is now 3½d. per kWh for the first 300 kWh per quarter, 3¼d. per kWh for the next 300 kWh, and for all in excess 3d. per kWh. The minimum charge of 7s. 6d. per quarter in the case of this rate and also that for late shop window lighting (2d. per kWh) is amended to 5s. during the summer quarters. Under the maximum demand lighting rate for shops and hotels the fixed charge is reduced from £10 to £8 per annum per kVA installed, the "unit" charge being ½d. In the case of domestic heating the intermediate rate of 1d. per kWh is abolished, all consumption over 100 kWh per quarter now being charged at ½d. Likewise with small power users, the 1½d. intermediate rate is discontinued. There are, in addition, modifications in the special private house domestic rate, the large power users' rate and the restricted supply rates for motive power and bakers' ovens.

Sevenoaks.—PROTEST AGAINST CHARGES.—A letter has been sent to the Minister of Transport by twenty trading concerns in the town protesting against the charges (especially for power) of the Sevenoaks and District Electricity Co., Ltd. The power charges are given as: First 100 kWh per quarter at 3½d. per kWh; next 100 at 3d.; next 1,000 at 2¾d.; next 1,000 at 2¼d.; and all in excess at 1¾d.

Reorganisation of Electricity Distribution

A DEPUTATION is being organised by the Convention of Royal Burghs of Scotland to the Scottish Members of Parliament in opposition to the Government scheme for the co-ordination of electricity supply services. Every burgh is being asked to send a representative.

At a meeting of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board last week the chairman said that Ashton-under-Lyne and the Board were willing to merge, but the Board did not want to join with Oldham. He added that the Board was negotiating for the purchase of the Glossop undertaking. It had been advised by the Electricity Commissioners to take over the Glossop undertaking if reasonable terms could be arranged.

Opposition to the proposals has been expressed by the Fleetwood Council, Alderman Saer, chairman of the Electricity Committee, being of the opinion that a large amalgamation, including Preston, Blackpool, Lytham, and Thornton Cleveleys would be unwieldy and would not serve the consumers nearly so well as the separate undertakings.

Last week a conference of Kent Borough and Urban District Councils decided that the proposals should be strenuously opposed.

A resolution of protest was unanimously adopted at a recent meeting of the Elland (Yorks) Urban District Council, and a similar step has been taken by the Honley (Yorks) Council.

The Fulham and Islington Metropolitan Borough Councils, while agreeing in principle with the necessity for a national scheme for the reorganisation of electricity distribution, are opposed to the proposals on various grounds.

A conference was held in Cardiff recently at which representatives of fifty-two South Wales local authorities considered the proposals. The conference decided in favour of South Wales being split up into three areas, Swansea to deal with the west, Cardiff the centre and Newport the east. These proposals are being placed before the Electricity Commissioners.

That Scunthorpe would be adversely affected financially if the proposals were carried out was stated by the chairman of the Electricity Committee at a recent meeting of the Council. He said that the undertaking contributed to the relief of the rates, and paid an amount for the services of the town clerk and borough treasurer, while electricity was sold very cheaply indeed for street lighting.

Scarborough.—EXTENSIONS.—Consideration is being given by the Town Council to the extension of the supply to Hackness at a cost of £2,839 and to Gallows Hill, Wykeham (£165).

LOAN.—The Electricity Commissioners have sanctioned the borrowing of £1,445 by the Town Council for the equipment and cable work for a sub-station at Cook's Row.

Sheffield.—SWITCHGEAR.—The Electricity Committee has obtained sanction to borrow £10,848 for switchgear for Blackburn Meadows power station.

South Shields.—SUB-STATIONS AND EQUIPMENT.—Sanction has been received from the Electricity Commissioners by the Town Council to borrow £2,211 for additional equipment for the Barrington Street, Fowler Street and Holborn sub-stations. The Council also proposes to erect a sub-station at West Holborn.

Stone.—LOWER CHARGES.—The Urban District Council has authorised reductions in electricity charges. The lighting rate is to be reduced from 6d. to 5½d. per kWh, with a concession of ½d. per kWh for business premises and offices, and power from 3½d. to 2d. per kWh for the first 480 kWh, and thereafter to 1½d. per kWh.

Tynemouth.—STREET-LIGHTING CONTROL.—The borough surveyor recently reported to the Electricity Committee that the impulse system of street-lighting control had been installed at Cullercoats and on the Balkwell and Ridges estates, and he recommended that, before proceeding with the remainder of the borough, a period of six months should be allowed to elapse in order that he might report as to the efficiency of the system.

INCREASED SALES.—The borough electrical engineer has reported to the Town Council that during the past two months there has been a large increase in the output of the electricity undertaking. This, he states, is due to the increase in supplies for industrial purposes and also to the number of cookers, water heaters, &c., in use.

Uruguay.—HYDRO-ELECTRIC SCHEMES.—It is reported that the Government has placed with German firms the contract for the construction of the Rio Negro hydro-electric works with a dam to be completed in five years at an expenditure which is said to amount to 75 million Rm.

Wallasey.—ELECTRICALLY HEATED PRESSES.—The Electricity Committee has agreed to supply electricity to the Gandy Belt Manufacturing Co., Ltd., for use in connection with electrically heated presses at the standard scale for the central heating of buildings during off-peak hours.

Wakefield.—ELECTRIC BOILER.—The Health Committee has authorised the city electrical engineer to install an electric boiler at the maternity hospital.

FRINGE ORDER.—The Electricity Committee is to seek a Fringe Order to enable a supply of electricity to be provided to houses on the Corporation's estate at Eastmoor.

West Hartlepool.—OVERHEAD LINES.—An agreement has been reached between the Town Council and the North-Eastern Electric Supply Co., Ltd., regarding the erection of overhead lines in Stockton Road and Seaton Lane. The Ministry of Transport held an inquiry into the scheme some time ago.

Whitley and Monkseaton.—ILLUMINATIONS SCHEME.—A sub-committee has been appointed to consider and submit an illuminations scheme. Last year, following an inquiry by the district auditor, councillors who voted for the illuminations were threatened with a surcharge, but they were afterwards relieved of this by the Minister of Health, who held that they had acted in good faith. A letter has recently been received saying that the Minister is not prepared to give any sanction which will have the effect of removing the expenditure on illuminations from the district auditor's review.

Wolverhampton.—STREET LIGHTING.—Permission is being sought by the Electricity Committee to borrow £15,000 for street lighting.

EXTENSION.—A sum of £226 is to be spent on extending mains to the aerodrome.

Worthing.—SUPPLY TO ESTATE.—The Electricity Committee is in negotiation with Stride & Son regarding the provision of a supply to the Field Place estate. The cost is estimated at £47,130.

EXTENSION OF POWER STATION.—The power station is to be extended at a cost of £3,500.

LOANS.—Sanction is being sought to borrow £17,591 for high-voltage cables and switchgear.

Traction

Bingley.—SUPPLY FOR TRAMWAYS.—The Electricity Department, which supplies electricity to the Bradford Corporation for a section of the tramways, has agreed terms for a continuation of the supply. In the near future the trams are to be supplanted by trolley-buses.

Cardiff.—OIL- *v.* TROLLEY-BUSES.—The Electricity Committee has passed a resolution urging the Transport Committee to investigate fully the question of using trolley-buses instead of oil-buses to replace the trams on two routes.

Coventry.—DISCONTINUANCE OF TRAM SERVICE.—The Transport Committee proposes to discontinue the Broadgate Station tram service.

Derby.—FIRST DAIMLER TROLLEY-BUS TESTED.—The first four-wheel trolley-bus to be completed by Transport Vehicles (Daimler), Ltd., was tried out under working conditions at Derby recently. The trial was made by courtesy of Mr. P. W. Bancroft, general manager of the Corporation Transport Department. The new vehicle was given a thorough test for

A Daimler trolley-bus being tried out at Derby

acceleration, braking, riding comfort, manœuvrability and silence, and the engineers afterwards stated that they were extremely satisfied with its performance.

Southern Railway.—PORTSMOUTH ELECTRIFICATION INAUGURATED.—As reported in our last issue (page 8), the company's latest electrification scheme, from Hampton Court Junction to Portsmouth and from Woking to Alton, was officially inaugurated on July 1st. Greeting the officials and others who travelled on a special train, the Lord Mayor of Portsmouth, Mr. F. J. Spickernell, thanked the company for providing the new facilities for more comfortable, speedy and safe travel, and suggested that the railways would become still more popular if one-class services were introduced. Mr. R. Holland Martin, chairman of the company, briefly responded. A toast to "The Success of the Southern Railway Electrification to Portsmouth and Southsea" was proposed by Major Sir Herbert Cayzer, M.P., at a subsequent luncheon, presided over by the Lord Mayor at the Guildhall. Commenting on the speed at which the scheme had been carried out, he said that while the Brighton section had taken two and a half years the Portsmouth line, nearly double the length, had taken only about one and a half years. This was the longest track section so far electrified and brought the total track mileage to 1,408. Since 1925 £16 millions had been spent on electrification. Portsmouth was a progressive town and the new scheme would materially benefit its inhabitants. In response, Mr. Holland Martin outlined the quicker and more frequent service that was to be introduced and said that this represented only the first part of the electrification scheme. In about a year's time it would be possible to go by electric train from Portsmouth to Hastings. The company believed in the public travelling in comfort, and for journeys such as that between London and Portsmouth the railroad could beat the road at any time. The health of the Lord Mayor was proposed by Sir Herbert Walker, general manager of the company.

York.—ELECTRIC VEHICLE RUNNING COST.—The Electricity Committee reports that an electric delivery van which has been in use for nearly a year has run 7,250 miles at a cost of 0.564d. per mile.

Communications

Argentina.—BROADCASTING.—The Argentine Government has decided to allot 300,000 pesos (about £18,500) for improving the State wireless services.—*Reuter* (Buenos Aires).

Brazil.—TELEPHONE PROGRESS.—Reference is made in the annual report of the Brazilian Traction, Light and Power Co., Ltd., for 1936 to the progress made by its affiliated telephone undertakings. The number of telephones in service on the various systems at the end of the year was 165,852, as against 149,034 at the close of 1935. Of these, 99,988 were of the automatic type, an increase of 26,314 during the year. Toll-line extensions placed in service totalled 2,020 miles, underground conduit constructed 155 miles, underground cable laid 64 miles, and overhead lines erected 81 miles.

Great Britain.—REDUCED TELEPHONE CHARGE.—On July 1st the charge for a three-minute call to Iceland was reduced from £1 10s. to £1 4s.

Holland.—NEW TELEPHONE CABLE TO ENGLAND.—It is reported from the Hague that as the three existing telephone cables between Holland and England are insufficient for the traffic it is intended to lay down a fourth cable.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—SYDNEY.—July 29th. County Council. One 100-ton electrically operated travelling crane at Bunnerong power station. (T.Y. 24347/37.)*

MELBOURNE.—August 10th. State Electricity Commission of Victoria. One experimental high-capacity self-cleaning disc screen, in accordance with Spec. No. 37/55. Agent-General for Victoria, Melbourne Place, London, W.C.2.

Barking.—July 16th. Borough Council. Electrical installation work in connection with a new Fire Brigade headquarters in Alfred's Way. (July 2nd.)

Birmingham.—July 19th. Watch Committee. Electric lighting and power supply and one electric passenger bed lift at the new Pathological Block Mortuary, Newton Street; and electric lighting and power supply at the new Digbeth Police Station. H. J. Manzoni, city engineer, Council House (deposit £2 in each case).

Blackpool.—July 27th. Borough Council. Stores, &c., for one year. (See this issue.)

Bristol.—July 30th. Corporation. Reactors, transformers, switchgear, &c. (See this issue.)

Bury.—July 19th. Electricity Committee. Twelve months' supply of p.i. l.c. cables. (July 2nd.)

Cardiff.—July 13th. R.D.C. Electricity Department. Two 11-kV automatic circuit-breakers and one 200-kVA transformer. (July 2nd.)

Castle Douglas (KIRKCUDBRIGHTSHIRE).—July 12th. Town Council. Electrical work at housing estate. Purdon Smith, 95, Irish Street, Dumfries.

Chelmsford.—July 12th. Borough Council. Rewiring of electrical installation at the Trinity Road school. V. J. Willis, borough engineer, Municipal Offices (deposit £2 2s.).

Dartford.—July 24th. Borough Council. Cable. (See this issue.)

Dundee.—July 12th. Housing Department. Electric lighting at Beechwood housing estate. City quantity surveyor.

Egypt.—CAIRO.—August 24th. Ministry of Public Works. Electric pumping station and its transmission line connection, complete with building work, machinery and accessories, at Bosat. Chief inspecting engineer, Egyptian Government, 41, Tothill Street, London, S.W.1 (deposit £3 1s. 6d. not returnable).

Finchley.—July 26th. Borough Couucil. Electrical supplies for eighteen months. (See this issue.)

Halifax.—July 14th. Town Council. Electric lighting at Warley Road, Caddy Field and Salterlee schools. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £1 1s.).

Hull.—Telephone Committee. Bronze wire. (See this issue.)

Inverness.—July 19th. Town Council. Electric lighting at the South Kessock housing estate (6th. development). W. Smith, architect, 52, High Street.

Irish Free State.—DUBLIN.—August 7th. Electricity Supply Board. One 8,000-kVA transformer, with on-load tap-changing equipment, at the generating station, Ardnacrusha, Limerick. (See this issue.)

Kingston-upon-Thames.—July 31st. Corporation. E.h.v., indoor type, remote controlled switchgear. (See this issue.)

Leeds.—July 12th. Housing Committee. Wiring of houses on various estates. A. H. Linnett, housing director, 26, Great George Street (deposit £2).

Liverpool.—July 12th. Corporation. One steam generating set and alterations and additions to switchboard at Smithdown Road Hospital. Land steward and surveyor, Municipal Buildings.

London.—FULHAM.—July 21st. Borough Council. House telephone, fire alarm and call sign systems at the power station, Townmead Road. (July 2nd.)

Manchester.—July 19th. Electricity Committee. 6,600-V and 400-V overhead lines, with switchgear and one 25-kVA transformer. (See this issue.)

Middlesbrough.—July 12th. Corporation. Twelve months' supply of cables. (July 2nd.)

Newton-in-Makerfield.—July 10th. U.D.C. Electricity Department. One 400-kVA transformer. (June 25th.)

New Zealand.—WELLINGTON.—October 5th. Public Works Department. 20,000-kVA transformer bank. (T.Y. 24415/37.)*

August 10th. Engine-driven generating sets and switchgear. (T.Y. 24741/37.)*

October 26th. Four 2,500-kVA transformers and accessories. (T.Y. 24834/37.)*

November 2nd. Testing transformer, induction regulator, control bench, switchgear, &c. (T. 24835/37.)*

Prestatyn.—July 19th. U.D.C. Electricity Department. Cable. (See this issue.)

Sheffield.—July 13th. Electricity Committee. One 13-panel board for 33-kV switchgear. (June 25th.)

South Africa.—JOHANNESBURG.—August 3rd. Railways and Harbours Administration. One 3-ton and eight 5-ton overhead electric travelling cranes. (T.Y. 24344/37.)* Two 7-ton and two 150-ton overhead electric travelling cranes. (T.Y. 24343/37.)*

July 17th. City Council. Stationary battery and equipment. (T.Y. 24345/37.)* One bank of 3,000-kVA transformers. (T.Y. 24269/37.)*

July 24th. House service type electricity meters. (T.Y. 24641/37.)*

August 14th. Three 6,000-kVA transformers, with associated equipment, for the Forest Town sub-station. (T. 24644/37.)*

PORT ELIZABETH.—July 22nd. City Electrical Engineer's Department. Transformers, cables, switchgear, meters, &c. (T. 24623/37.)*

PRETORIA.—June 30th. Union Tender and Supplies Board. Line material. (T. 24533/37.)*

August 6th. H.v. and l.v. switchgear and one 25-kVA transformer. (T.Y. 24649/37.)*

UNIONDALE.—July 26th. Municipality. Plant for power station and distribution network. (T.Y. 24794/37.)*

South Cambridgeshire.—July 27th. R.D.C. Duplicate vertical spindle centrifugal borehole pumps (8,000 gal. per hr. each), driven by electric motors, with automatic operation, and accessories. Sands & Walker, consulting engineers, Milton Chambers, Nottingham (deposit £2 2s.).

Southend.—July 12th. Town Council. Electrically driven pumping installation comprising two sewage pumps (500-gal. per min. each) and two storm water pumps (3,500-gal. per min. each), with electric motors, switchgear, &c. J. D. & D. M. Watson, 3, Central Buildings, Westminster, London, S.W.1 (deposit £3 3s.).

Stockport.—July 12th. Public Assistance Committee. Invisible panel heating and electric lighting and power installations in connection with the erection of new maternity wards at the Stepping Hill Hospital. H. Barlow, clerk to the Committee, Public Assistance Offices (deposit £5 in each case).

Wallasey.—July 13th. Borough Council. Water pumping machinery, cast-iron connections, electric motor (about 167 h.p.), automatic control equipment and cables. Borough gas and water engineer, The Gasworks.

Warrington.—July 20th. Health Committee. Electric lighting, heating, power, clocks, signalling, fire alarms, radio and telephones at the Borough General Hospital. (See this issue.)

*Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Australia.—MELBOURNE.—City Council. Accepted. 60,000-yd. of triple braided cable (£663).—Callender's Cable & Construction Co.—*Tenders.*

Barking.—Housing Committee. Recommended. Electrical installations in houses in Ripple Road (£142) and Abbey Road (£263).—R. F. Webb.

Highways Committee. Recommended. Street fire alarm system (£1,700).—Automatic Telephone & Electric Co.

Electricity Committee. Recommended. Switch panel (£149).—New Switchgear Construction Co. Sub-station distribution boards (£164).—W. Lucy & Co. Feeder pillars (£339).—Siemens Bros. Cables (£1,455).—Henley's. Cable covers (£41).—H. J. Baldwin & Co.

Bradford.—Transport Committee. Recommended. Fifty-seven double-deck trolley vehicles (£125.884).—English Electric Co.

Baths Committee. Recommended. Electric lighting installation at Lister Park baths (£185).—L. Crawford.

Eastbourne.—Watch Committee. Electrical installation at Police Station:

	£		£
F. W. Blanshard. Accepted ...	**808**	H. Beney & Son	1,123
A. Davis	856	F. J. Wordley	1,124
G. N. Haden & Sons	940	A. J. Bessant	1,138
Braine & Parris	1,017	Miller & Selmes	1,145
L. Moorton	1,040	Drake & Gorham...	1,221
Lovells	1,059	Page & Miles	1,325
Chapman, Lowry & Puttick ...	1,083	Eames & Calverley	1,529

Eccles.—Electricity Committee. Accepted. Meters.—Met.-Vick. Elecl. Co.; British Electric Meters.

Glasgow.—Corporation. Accepted. Electrical installations at forty-eight houses in Culross Street.—A. & C. Edelman.

Hyde.—Town Council. Accepted. Electrical installations in ninety-four houses in Dukinfield Road and twenty-two houses in Hennelly Street.—Johnson & Turner.

Irish Free State.—SLIGO.—Town Council. Accepted. Electrical installations in houses at Barrack Street (£250).—G. Fitzpatrick.

London. — ST. MARYLEBONE.—Borough Council. Accepted. H.v. metal-clad switchgear (£69,940).—Ferguson, Pailin. Construction of ducts and laying of cables (£5,275).—Constable, Hart & Co.

Manchester.—Education Committee. Accepted. Electrical installation at Abbey Hey school.—J. Collier. X-ray apparatus for the Central school clinic.—Mottershead & Co.

Electricity Committee. Accepted. Supplies for twelve months: Electricity meters.—Ferranti, Ltd.; Met.-Vick. Elecl. Co. Electric kettles.—Premier Electric Heaters; Bulpitt & Sons. Electric motors.—B.T.H.; Laurence, Scott & Electromotors. Reblading turbines at Barton power station.—Met.-Vick. Elecl. Co. Ash handling plant for the Barton station.—Jenkins & Co.

Housing Committee. Accepted. Electrical installation in seventy-two flats at Gorton.—Maitland & Co.

Newmilns.—Town Council. Accepted. Lighting at the East Gilfoot housing estate (£284).—Edison Swan Electric Co.

Nuneaton.—Town Council. Recommended. Kiosk sub-station complete with e.h.v. and l.v. switchgear and a 200-kVA transformer.—Met.-Vick. Elecl. Co.

Scarborough.—Town Council. Accepted. Switchgear and two 300-kVA transformers for the Wheatcroft sub-station (£1,677)

and switchgear for the Northstead sub-station (£1,130).—Met.-Vick. Elecl. Co.

Sheffield.—Electricity Committee. Accepted. Two 750-kV glass bulb mercury-arc rectifiers and equipment for the Kelham sub-station (£3,654).—Electric Construction Co.

South Kesteven.—R.D.C. Accepted. Electrically driven bore-hole pump at Castle Bytham.—Haywood, Tyler & Co.

South Shields.—Town Council. Accepted. Electrical installation at the new Junior Instruction Centre and the Dean Road Practical Instruction Rooms.—Law & Burns.

Wolverhampton.—Water Committee. Accepted. Electric pumping plant at the Cosford waterworks (£1,969).—Harland Engineering Co.

Worthing.—Electricity Committee. Accepted. E.h.v. switchgear for the power station (£11,991).—B.T.H.

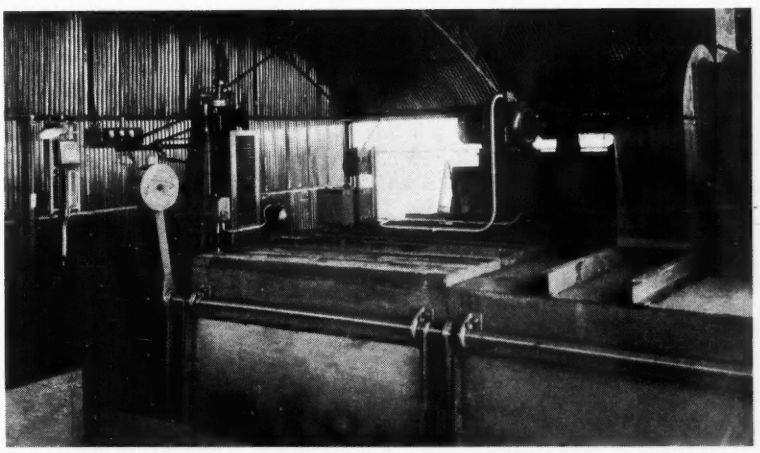
Notes

Physics Congress in France

An international congress on physics, chemistry and biology is to take place in the "Palace of Discoveries" at the International Exhibition in Paris, France, from September 30th to October 9th. Many of the leading universities and colleges of Europe and the U.S.A. will be represented and among those taking part will be Sir P. M. S. Blackett, London University, and Messrs. M. Polanyi (Manchester University), J. D. Cockcroft, J. Needham and C. H. Waddington (Cambridge University), and J. B. S. Haldane (University College, London). The secretary of the congress is M. L. W. Tomarkin, Institut de Chemie, 11, Rue Pierre-Curie, Paris (5), France.

Hay Drying by Electricity

An electric hay drying plant has been installed at Manor House Farm, Malpas, Cheshire, by Messrs. A. E. Cheshire, electrical contractors. The main drying fan is driven by a 400-V 25-h.p. Metropolitan-Vickers slip-ring motor, and the baling machine is worked by a 400-V 6-h.p. squirrel-cage motor. The wiring is carried out in galvanised screwed tubing, using Callender's v.i.r. cable. The drying plant was made by Metropolitan-Vickers and the I.C.I., M.-V. motor starters being used.



The hay-drying installation at Manor House Farm

Fire Extinguishers

The British Standards Institution has just issued a specification for portable chemical fire extinguishers (B.S.S. No. 740) dealing with the foam type and carbon-tetra-chloride extinguishers. This specification forms a supplement to the acid-alkali type of portable chemical fire extinguishers and together they cover, amongst other things, the materials and construction, shape, method of actuating, dimensions and thickness, the chemical charge, and gas expansion space. Copies of this British Standard (No. 740-1937) may be obtained from the Publications Department of the Institution, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Chemical Congress Proceedings

The Chemical Engineering Congress of the World Power Conference was the first of its kind. The transactions have now been published (London: Percy Lund Humphries & Co., Ltd., price £12 net per set, carriage extra) in five volumes which divide the subjects dealt with into twelve sections. Electrolysis and electrical applications are recorded in the second volume. Most of the 121 papers are printed in English, while all of them are provided with summaries in English, French and German.

World Power Conference

The International Executive Council of the World Power Conference met in Paris on June 29th. Sir Harold Hartley, C.B.E., F.R.S., the chairman, presided and twenty-one National Committees were represented. It was decided unanimously to accept the invitation of the Austrian National Committee to hold a sectional meeting in Vienna at the end of August and beginning of September, 1938. The topics to be discussed at this meeting will centre round "the energy-requirements of agriculture, small-scale industry, the household, public lighting and electric railways." All these subjects will be considered as much in their economic as in their purely technical aspects.

Consideration was then given to the second Chemical Engineering Congress of the World Power Conference, to be held in Berlin in 1940. An invitation was received from the Japanese National Committee for the fourth plenary meeting of the World Power Conference to be held in Tokyo in 1942 and this was unanimously accepted.

Motors for Coal-cutters and Mine Conveyors

The British Standards Institution has just issued a specification covering flameproof electric motors embodied in, or designed for operating, conveyors, coalcutters, loaders and other purposes for use in mines. It applies to machines having windings insulated with Class A or B materials as defined in an appendix and wound for up to 650 V, being applicable to the motors used with the larger types of electric drilling machines which are mounted on stands, but not suitable for the smaller type of coal drills which are held in the operators' hands. It is to be understood that a six-hour rating for conveyor motors and one-hour rating for coal-cutter motors are not necessarily the correct ratings in all circumstances, and manufacturers are at liberty to state additional ratings to meet the conditions associated with particular applications. Copies of the new specification (No. 741-1937) can be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

The A.S.L.I.B. Conference

The fourteenth annual conference of the Association of Special Libraries and Information Bureaux is to be held at Gonville and Caius College, Cambridge, during the week-end of September 24th-27th. Accommodation will be allotted at £3 per head (£4 for non-members) inclusive of meals, &c. Full information is obtainable from the secretary, Miss E. M. R. Ditmas, 31, Museum Street, London, W.C.1.

Appointments Vacant

Electrical engineering mechanic for the L.C.C. at the South-East London Technical Institute.

Outside sales assistant for Luton Electricity Department.

Electrical fitter for Walthamstow electricity undertaking.

Assistant in consumers' engineer's department, clerk in accounts department and meter tester and repairer for Ealing Electricity Supply Department.

Workshop electrician and meter mechanic for Barnstaple Electricity Department.

Lady cookery demonstrator for Chichester Electricity Department.

Assistant lady demonstrator and showroom assistant for Swansea Electricity Department.

Chief assistant electrical engineer for Blackburn electricity undertaking.

Demonstrator for Scunthorpe Electricity Department.

Showroom assistant for Epsom and Ewell Electricity Department.

Civilian wireless instructors, instrument maker instructors, and mechanical and electrical engineering assistants for the Air Ministry.

Visiting teachers for the L.C.C. at South East London Technical College.

Assistant lecturer in electrical engineering at the Battersea Polytechnic.

Two junior mains assistants for Ayrshire Electricity Board.

Meter repairer and calibrator for Hornsey Electricity Department.

Junior charge engineer for Darlington Electricity Department.

Meter tester and repairer for the Westmorland and District Electricity Supply Co.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

HELIOGEN-REX bakelite push-button earthing switch.
ELEOTRIX vacuum cleaner.
HUGHES patent torch for casks, jars, &c.
LITTLE WONDER soldering iron.
ADMO switches.

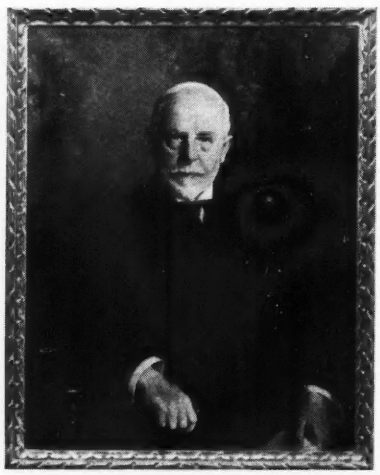
Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. L. Morgan Smith has resigned his position with Smith Meters, Ltd., in order to take up a post with the Electricity Commission. **Mr. G. L. Neilson** has been appointed to represent Smith Meters, Ltd., in the South West of England and the South Wales area, the district formerly covered by Mr. Smith.

Mr. Sydney Evershed was on June 30th presented with a portrait of himself painted by Mr. G. Harcourt, R.A. The presentation marked the completion of fifty years service by Mr. Evershed as manager, director, and chairman of the directors of Evershed & Vignoles, Ltd., and its predecessors. The portrait, with Mr. Evershed's permission, will eventually be handed to the Institution of Electrical Engineers to hang in the Council Chamber. Mr. Evershed was also presented with a book in which were written the names of the contributors, all of whom were associated with Mr. Evershed in some connection or else with Evershed & Vignoles, Ltd., starting with Mr. A. P. Trotter, a partner in the original firm of Goolden & Trotter, and finishing with the most recent employé of the company. Mr. E. B. Vignoles made the presentation. Mr. A. Vines presented Mrs. Evershed with a set of three silver cake dishes.



A portrait of Mr. S. Evershed by Mr. G. Harcourt, R.A.

Mr. R. Percival, A.M.I.E.E., has been appointed chief testing engineer with Switchgear & Cowans, Ltd., Manchester.

Mr. C. P. N. Rand, M.A.(Eng)., A.M.I.E.E., has been appointed an additional director of Electrical & Engineering Products, Ltd. Mr. Rand was trained with the Metropolitan-Vickers Electrical Co., and at Caius College, Cambridge, after which he was with the English Electric Co. on switchgear erection and later at Budapest on power station construction. Immediately prior to joining Electrical & Engineering Products, Ltd., he was for five and a half years in the service of the Central Electricity Board, North East England Area, dealing with sub-station operation and the maintenance and repair of grid lines.

In our last week's note relating to **Viscount Falmouth** we should have stated that he was a *past* vice-chairman of the London and Home Counties J.E.A. Alderman Dudley Stuart is the present vice-chairman.

[*Jerome, Ltd.*

Mr. G. N. Walker

Mr. G. N. Walker has been appointed Midland area manager to Ensign Lamps, Ltd., in succession to **Mr. W. G. Lund,** who has taken up a position at the company's head office.

Mr. J. W. Hadfield, formerly borough electrical engineer at Barnstaple, has been presented by the Corporation with a silver salver in recognition of his long service to the town. Until his recent retirement Mr. Hadfield had been borough electrical engineer at Barnstaple for thirty-five years.

Dover Town Council has decided to extend the service of the borough electrical engineer, **Mr. R. C. Harpur,** who is entitled to retire in October next, for a period of six months or until such time as a definite decision is made in regard to the future of the undertaking.

Mr. Norman H. Hunt, at present on the staff of the Ayrshire Electricity Board, has been appointed district engineer by the Dumfries County Council. After an apprenticeship and subsequent service with Johnson & Phillips, Ltd., Mr. Hunt was connected with the Dunoon & District Electric Supply Co., Ltd., before joining the Ayrshire Board.

I.E.E. Awards.—The Council of the Institution of Electrical Engineers has awarded the following premiums for students' papers for the session 1936-37:—Students' premiums value £10: Messrs. J. E. Houldin (Liverpool), W. E. Laycock (Ilford), and P. M. Newman (Stourport). Students' premiums value £5: Messrs. H. K. Bourne (Rugby), W. J. Cozens (Edinburgh), J. D. Evershed (Rugby), J. W. Fair (Birmingham), G. V. Harrap (Hull), D. N. A. James (Sheffield), G. Owens (Rugby), and J. A. Stanfield (Newcastle-on-Tyne).

Mr. A. Latham, chief assistant electrical engineer at Blackburn, has been appointed chief electrical engineer to the Mansfield Corporation in succession to Mr. E. F. H. Hewlett, who is retiring. Mr. Latham received his training in the generating station and the mains department of the Southport Corporation electricity undertaking, subsequently serving as mains assistant with that undertaking. In 1926 he was appointed district engineer with the Electricity Distribution of North Wales and District, Ltd., joining the Wolverhampton Electricity Department in 1930 as distribution engineer. He was appointed to his present position with the Blackburn Corporation about three years ago.

Mr. A. Latham

Mr. S. Coote, late manager for H. E. Keen & Co., Ltd., has joined the staff of Wilec, Ltd. Mr. Coote will look after the interests of the company in the south-west and west districts of London.

Professor W. G. Cady, professor of physics at the Wesleyan University, Middletown, Connecticut, U.S.A., is to be presented with the Duddell Medal at this evening's meeting of the Physical Society, at the Imperial College of Science and Technology, South Kensington, at 5.15 p.m. The Council of the Society has chosen Professor Cady for the award for his work on piezo-electric resonators and oscillators as standards of frequency. Professor Cady's pioneer work on this subject was published in 1922, and the value of the device may be judged from the fact that it stimulated research work on the subject in all parts of the world, over a thousand papers having been published on the properties of piezo-electric crystals since the appearance of Cady's first paper.

Mr. J. C. Jones, principal of the St. Helens (Lancs) Municipal Technical School and School of Art, has been selected to succeed Mr. Charles Coles as principal of the Cardiff Technical College. The salary attached to the position is £850, rising to £1,000 per annum.

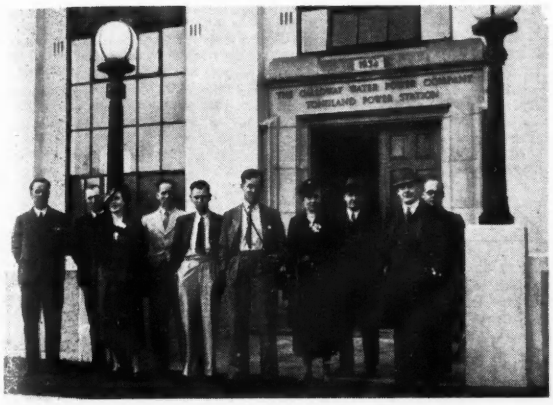
Dr. John E. Wilcken, for the past thirteen years a lecturer in the Electrical Engineering Department at Armstrong College, Newcastle-upon-Tyne, is leaving shortly to take up the position of editor of *Science Abstracts* (Section B, Electrical Engineering). Dr. Wilcken was born at Aarhus, Denmark, and took his degree of B.Sc. at Copenhagen. Until 1910 he was chief electrical engineer of his native town, and before going to Newcastle had held prominent positions in America and Buenos Aires.

Dr. J. E. Wilcken

Alderman W. Walker has been re-elected chairman of the National Joint Board for the Electricity Supply Industry for the eighteenth successive year.

Eight honorary memberships of the Engineering Institute of Canada were conferred at the semi-centennial meeting of the Society held in Montreal during June. The engineers honoured included **Sir Alexander Gibb,** president of the Institutional of Civil Engineers, and **Dr. G. H. Duggan,** a past president of the Engineering Institute of Canada.

Members of the Carlisle Branch of the Electrical Contractors' Association recently visited Tongland hydro-electric power station, near Kircudbright, at the invitation of the engineer, Mr. Williams. After being conducted round the



Members of the Carlisle Branch of the Electrical Contractors' Association at Tongland hydro-electric power station

station by Mr. Gerrard, the resident engineer, the party adjourned to the Commercial Hotel, Dalbeattie, where they were entertained to tea by Mr. Little, the Carlisle manager of Downes & Davies, wholesalers.

Mr. J. W. C. Robinson, M.A., has resigned the chairmanship of the Relay Services Association owing to ill health.

Mr. E. W. J. West

Mr. E. W. J. West, chief accountant of the General Electric Co., Ltd., who retired on June 30th, joined the company forty-one years ago. He was appointed chief accountant to the company in 1901 at the early age of twenty-five. On June 29th, at a lunch at the Connaught Rooms, Lord Hirst, jointly with Mr. M. J. Railing, presented Mr. West with a gold watch as a mark of their personal appreciation of his long and valued service. At the same time, Lord Hirst presented Mr. West, on behalf of his colleagues, with a silver tea service and an illuminated album of signatures.

Miss Caroline Haslett, C.B.E., Companion I.E.E., has been appointed a member of the Court of Governors of the London School of Economics and Political Science (University of London). **The Viscountess Rhondda** was appointed at the same time.

Sir John Dewrance has retired from the chairmanship of the board of Babcock & Wilcox, Ltd., but will remain a director. **Lt.-Col. J. H. M. Greenly** (deputy chairman) succeeds him as chairman and **Mr. A. McKinstry** becomes deputy chairman in addition to his position as managing director.

Mr. R. Smith, assistant manager of the Glasgow Corporation Transport Department, is recommended for the post of general manager in succession to Mr. J. N. Wilson, who is retiring under the age limit in November. Mr. Smith, who is fifty-nine, entered the service of the Tramways Department at its inception in 1894. The salary will be £1,500, rising to £2,000 a year.

Mr. J. L. Eve has been elected chairman of the Transmission Section of the Institution of Electrical Engineers for the session 1937-38.

Obituary

Mr. J. E. Thomas.—The death has occurred while on holiday in London of Mr. Joseph Edward Thomas, an official of the Dunston power station. Before coming to Dunston he was with the Otto Vale power Station, Blaydon.

Mrs. A. J. Tracey.—We regret to record the death of the wife of Mr. A. J. Tracey, works manager, Derby Cables, Ltd., which occurred on June 29th after a long illness.

Mr. J. MacLachlan.—The death occurred at his home at Hampstead on June 22nd of Mr. James McLachlan, M.I.E.E. He was seventy-four years of age.

Herr. Ing. G. F. von Traisenac.—The death is reported from Vienna of Herr Ing. G. Frimmel von Traisenac, who had been for many years a director of the Austrian Brown-Boveri Co., and was a leading Austrian electrical engineer.

Dr. Henry Homan Jeffcott, secretary of the Institution of Civil Engineers, whose death was announced in our last week's issue, was born in 1877. He was educated at Trinity College, Dublin, and from 1902 to 1904 he was trained as an assistant with Siemens Bros. & Co., Ltd., at Woolwich and Stafford, and from 1904 to 1905 he worked at the Openshaw works of W. G. Armstrong Whitworth & Co., Ltd. He then became head of the Metrology Department of the National Physical Laboratory, London, and in 1910 he was appointed professor of engineering in the Royal College of Science for Ireland, Dublin, which post he held until 1922; during the last eight years of this period he was also dean of the Faculty of the College. During the War he was responsible for the manufacture of munitions in the College workshops. From 1918 to 1921 he held the post of secretary of the Water Power Resources of Ireland Sub-Committee, and was also examiner in mechanical engineering in the University of Belfast and in the National University of Ireland. During this period also he was associated with Sir John P. Griffiths in the preparation of a hydro-electric scheme for the River Liffey. Dr. Jeffcott wrote many papers on mechanical and electrical subjects, and was the patentee of several inventions, the best-known of which is his direct-reading tachometer. In 1922 he was appointed secretary of the Institution of Civil Engineers, which position he held until his death.

[Elliott & Fry

The late Dr. H. H. Jeffcott

Col. J. Schick.—The death occurred recently in New York Hospital of Colonel Jacob Schick, the inventor of the electric razor bearing his name.

Mr. C. H. Eden, secretary and director of B.E.N. Patents, Ltd., died on July 3rd after a short illness.

Will.—Mr. Edward Wallis, railway electrical engineer, left £15,032, with net personalty £10,274.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Calnorth Manufacturing Co., Ltd.—Private company. Registered July 2nd. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in metal, wood, electrical components, electric sound production and amplification apparatus, &c. The directors are: W. E. Edwards, Wyngarth, Ringmer, Sussex, and two others. Solicitors: Hunt, Nicholson, Adams & Co., Lewes.

H. B. Mattia, Ltd.—Private company. Registered July 3rd. Capital, £3,000. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, cabinets, loud speakers, television apparatus, &c. The directors are: H. B. Mattia and Mrs. Daisy Mattia, both of "Belmont," Down Road, Merrow, Guildford. Registered office: 25, Down Road, Merrow, Guildford.

Henry Lindsay, Ltd.—Private company. Registered July 3rd. Capital, £5,000. Objects: To acquire the business of a specialist in mechanical transmission carried on by Hy. Lindsay, at 47, Queen's Road, Bradford, also to carry on the business of electrical and mechanical engineers and contractors, &c. The directors are: Hy. Lindsay and L. Lindsay, both of 6, Brankfield Road, Shipley, and one other to be nominated by Smith & Grace, Ltd. Solicitor: N. A. Foster, 1, Cheapside, Bradford.

Superlamp, Ltd.—Private company. Registered June 30th. Nominal capital, £50,000. Objects: To adopt an agreement with Superlamp, Ltd., and its liquidator and C. J. Orgel and S. Orgel, to carry on, develop and turn to account the business of the said old company, and that of manufacturers of and dealers in electric, magnetic, galvanic, wireless, television, cinematographic and photographic goods, apparatus, accessories, devices and appliances, &c. The permanent directors

are: C. J. Orgel, 71, Chatsworth Road, Brondesbury, N.W.2, and S. Orgel, 18, Regents Court, Regents Park, N.W. Secretary: Joseph McGrath. Registered office: 6, Paul Street, Finsbury, E.C.2.

New Light Fittings, Ltd.—Private company. Registered June 30th. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in lamp fittings and equipment, &c. The directors are: A. J. A. Rogers, 115, Old Broad Street, E.C.2, and A. H. Lenham, 9, Oxford Street, W.1.

Espensen Electric Supply Co., Ltd.—Private company. Registered June 30th. Capital, £1,000. Objects: To acquire from C. W. Espensen the benefit of his invention relating to the production of electricity from hydrogen and the patent rights for Great Britain, Irish Free State, the British Empire, including the Colonies and Mandated Territories, &c. The subscribers are: B. H. Krieger and A. Krieger, 36, Menelik Road, N.W.2. First directors: B. H. Krieger, A. Krieger, C. W. Espensen, S. Sanson and F. Nahammerl. Registered office: 50, Cannon Street, E.C.4.

Hepworth & England, Ltd.—Private company. Registered July 1st. Capital, £5,000. Objects: To carry on business as electrical and automobile engineers and general electrical installation contractors, &c. The permanent directors are: S. Hepworth, 24, Mallinson Street, Westborough, Dewsbury, and A. England, 17, Bridle Street, Soothill, Batley.

Empire Lamp Shade Co., Ltd.—Private company. Registered July 1st. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in lamp shades, standard and table lamps, electrical fittings and accessories, &c. The directors are: J. L. Bowman, 194, Heathfield Road, Handsworth, Birmingham, and T. G. Blackwell, 21, Ravenscroft Avenue, Golders Green, N.W.11.

G. Ellam, Ltd.—Private company. Registered July 1st. Capital, £1,500. Objects: To acquire the business of a wholesale electrical supplier and factor and manufacturers' selling agent carried on by G. Ellam at 49, Gartside Street, Manchester. The subscribers are: G. Ellam, 67, Moss Bank, Higher Crumpsall, Manchester, 8, and two others. Secretary: G. Ellam. Registered office: 49, Gartside Street, Manchester.

Raeburn (London), Ltd.—Private company. Registered July 2nd. Capital, £500. Objects: To carry on the business of electricians, suppliers of electricity for light, heat, motive power or otherwise, &c. The permanent directors are: B. C. Dodsworth, 10, Peabody Estate, Vauxhall Bridge Road, S.W.1; and R. G. P. Barber, 11, Sutherland Street, S.W.1.

Returns of Electrical Companies

Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.—Capital, £40,000 in 11,500 "A" ordinary, 3,500 "B" ordinary, and 25,000 preference shares of £1. Return dated April 27th, 1937. 11,500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares taken up. £27,800 paid on 500 "A" ordinary, 2,300 "B" ordinary and 25,000 preference shares. £11,000 considered as paid on 11,000 "A" ordinary. Mortgages and charges, nil.

Musselburgh and District Electric Light and Traction Co., Ltd.—Satisfaction to the extent of £66,600 on April 21st, 1937, of 5 per cent. debentures authorised by resolutions of November 13th, 1905, and April 8th, 1909, and registered May 12th, 1909, securing £90,000. (Notice filed June 28th, 1937.)

Power Securities Corporation, Ltd.—Capital, £2,000,000 in 1,000,000 preference and 1,000,000 ordinary shares of £1. Return dated March 3rd, 1937. 500,000 preference and 800,000 ordinary shares taken up. £1,300,000 paid. Mortgages and charges, nil.

Electroway Heaters, Ltd.—Capital, £3,000 in £1 shares. Return dated March 25th, 1937. 2,510 shares taken up. £2,510 paid. Mortgages and charges, nil. A further 75 shares were allotted for cash and fully called up on April 14th, 1937.

Uxbridge and District Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £250.000 in £1 ordinary shares beyond the registered capital of £1,000.000. The Metropolitan Electric Supply Co., Ltd., holds practically the whole of the issued shares.

H. J. Cash, & Co., Ltd.—Capital, £25,000 in £1 shares. Return dated March 9th, 1937. 16,000 shares taken up. £11,000 paid. £5,000 considered as paid. Mortgages and charges, nil.

Geo. Bray & Co., Ltd.—Capital, £160,000 in 80,000 preference and 80,000 ordinary shares of £1. Return dated April 2nd, 1937. 55,000 preference and 55,000 ordinary shares taken up. £7 paid. £109,993 considered as paid. Mortgages and charges, £40,000.

Lincoln Radio Relay Service, Ltd.—The nominal capital has been increased by the addition of £3,600 beyond the registered capital of £9,000. The additional capital is divided into 3,000 ordinary shares of £1 and 2,400 ordinary shares of 5s.

Wolverhampton Radio Installation Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1936 (filed June 1st, 1937). 750 shares taken up. £750 paid. Mortgages and charges, nil.

North Metropolitan Power Station Co., Ltd.—Capital, £100 in £1 shares. Return dated March 30th, 1937. All shares taken up. £100 paid. Mortgages and charges, £2,521,226.

Invincible Electrical Engineering Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 13th, 1937. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Power & Lighting Cables, Ltd.—Capital, £10,000 in £1 shares. Return dated February 17th, 1937. 1,100 shares taken up. £1,100 paid. Mortgages and charges, nil.

Cricklewood Wholesale Electric, Ltd.—Capital, £750 in £1 shares. Return dated December 31st, 1936 (filed February 11th, 1937). 620 shares taken up. £620 paid. Mortgages and charges, nil. A return of allotments made up to February 19th, 1937, shows a further 130 ordinary shares allotted, payable in cash and fully called up.

Heating Elements, Ltd.—The nominal capital has been increased by the addition of £500 beyond the registered capital of £1,000. The additional capital is divided into 500 5 per cent. non-cumulative preference shares of £1.

City Notes

The General Electric Co., Ltd.—Presiding at the annual meeting held on July 1st, Lord Hirst (chairman and managing director), after referring to the death of two directors, Sir Newton Moore and Sir Austen Chamberlain, said that they had taken full advantage of the happy business conditions which prevailed during the year under review and the results, in consequence, had exceeded the achievements of any previous year. (The company's report was reviewed in our issue of June 25th.) The general reserve account amounted to slightly more than their ordinary share capital; it was not invested in special securities, but was required for working and financing their business. Demands for increased wages and possibly also a further increase in the cost of some raw materials, might make another considerable inroad on their cash resources, at least for a time. With regard to the balance sheet, on the liabilities side there was an increase of £440,000 for increased trade and other creditors, including provision for taxation, while on the assets side they had a corresponding increase of debtors and a rise of £800,000 in stock and work in progress. The armament programme had played no appreciable part in their activities in 1936 and the business of their engineering works was mainly due to the requirements of industry as a whole. A very satisfactory advance was experienced by their export trade. While they had not attained the record figure of 1929-30, when prices were higher, they had in volume exceeded it and had improved their respective share in the total exports of the British electrical industry. The bulk of their exports, 79 per cent., went to British territories overseas; increases were noticeable in the British West Indies, New Zealand, Malay States and Australia. However, South Africa was still their leading export market, claiming 21 per cent., while India was second with 18.25 per cent., and Australia third with 13 per cent. Another good feature was the increase in the export of wireless sets. Trading in China and France had received a slight setback and their exports to those countries had somewhat decreased: otherwise all overseas branches had a profitable and improved year's working. Particular mention should be made of their New Zealand company, which had gained a striking success. At home their success with pumpless, air-cooled, steel-clad, mercury-arc rectifiers continued; they were meeting a large home demand and orders were being executed for India, South Africa, China and Europe. Experimental work was being continued to produce units of larger sizes. In connection with equipment for steelworks the installation of a 20,000-h.p. rolling mill motor for Dorman, Long & Co. had been completed, this being one item of a scheme for which they had been responsible. Also a contract had been entrusted to them by Richard Thomas & Co. in connection with a new hot and cold strip and tinplate mill, and at Fraser & Chalmers Engineering Works 3,000 tons of mechanical plant was being constructed for this work. The contribution from Witton included rolling mill motors, transformers, switchboards and over 100 motors for driving mill auxiliaries. Still another contract included generating plant, compressors and a wide variety of equipment for a Turkish steel works. In paper mills they were installing the "Witton" unit sectional electric drive for papermaking machines, while important cotton mill electrification schemes had been completed both at home and abroad. They were designing and manufacturing the whole of the electrical equipment for an electrically propelled ferry-boat on the River Clyde, in which manœuvring was carried out by the electrically driven propellers—two at each end of the boat. Concerning railway electrification, the London Passenger Transport Board had recently ordered 800 motors, which would effect substantial improvements in service. With these motors the total number of G.E.C. motors supplied for London's underground railways would exceed 3,000. There was an increase in the number of equipments for trolley-buses which they were building, including those in hand for Canton. Another contract was for a 45,000-kVA transformer for the Central Electricity Board. At the Witton Development Department investigations were being undertaken relating to the application of thermionic valves and photo cells to heavy engineering and in this direction they had designed the control system for the bridge over the Forth in Kincardineshire, which was opened last autumn. Their Fraser & Chalmers works had undertaken the installation of an adjustable platform for the new swimming pool at Earl's Court which, it was believed, was the largest adjustable platform in the world, weighing about 1,000 tons. The telephone works had been engaged to its fullest capacity in the past year. Their telephone installation in the R.M.S. *Queen Mary* was so successful that they had been entrusted with similar equipment for the sister ship now under construction. Applications of carrier current as a channel of communication had developed rapidly, more especially in connection with multi-channel systems for underground cables. Electrical circuits, as a means of control, were being constantly introduced in many spheres, and one of the latest applications was the control of street lighting from a central point, without interfering with the main supply and without additional wires. Their attention was also being engaged in the use of radio short-wave transmission over short distances for the maintenance of communications in the event of a breakdown of the normal services. The future of television would seem to be dependent upon the development of the cathode-ray tube; from a commercial point of view, the lowering of prices and an improvement in programmes must precede the advent of any large demand for receiving sets. The Pirelli-General Cable Works had been fully occupied during the year and considerable extensions to the works were now in progress. Large contracts had been executed for 33,000-V cable for the electrification of the line from London to Portsmouth and in addition a number of contracts for 66,000-V oil-filled cable had been dealt with. The telephone cable from London to Cambridge, one of the first carrier cables to be installed by the G.P.O., was nearly completed and they had secured the contract for its extension to Leeds. Again it had been found necessary to extend the research laboratories. Electric discharge lamps were finding new applications and their research department had been successful in experimental work for highly resistant glass and other materials for these lamps. It had evolved a special alloy which was of much value in increasing the effectiveness of their h.p. switchgear and was now

dealing with defence developments on behalf of the Government. As to the future Lord Hirst thought they could safely reckon on continued progress for another few years, thanks to the present phase of prosperity created by the definite policy of the National Government. He agreed that there was a need for freer international trade, but he did not agree with some of the proposed methods of bringing it about. Our trade balance with almost every country from which we imported was against us and if people really desired to trade more freely it was they who should make a gesture to us. It was also natural for the worker to desire to share in the general recovery and it was to be hoped that negotiations on these lines would be conducted in a sane and patriotic way. Any increase of wages should not seriously interfere with our export trade.

The Victoria Falls and Transvaal Power Co., Ltd., reports a total income for 1936 of £1,473,097, as compared with £1,346,626 for the preceding year. After providing for depreciation, amounts written off, British taxation and renewals fund there is a balance of £586,365, which with £81,383 brought in, makes £667,748 available. The ordinary dividend for the year is maintained at 12 per cent. by a final payment of 8 per cent., reserve receives £100,000, and £135,831 is carried forward. The report states that the sales during the year represent a satisfactory increase over those of the previous year and the sales for the first six months of the current year show a further increase over those for the same period of 1936. The notified demands for additional supplies are greater than those at the beginning of the year under review. The work on the Klip power station has proceeded without interruption and at the end of the year five out of the six sets for which the station was originally designed were in commission. The remaining set was placed in service at the end of April this year. In view of the increase of demand and the notified demands to be provided for, it was decided to extend this station to double its original capacity. Contracts for practically the whole of the plant and work for this extension have been placed. Meeting: July 20th.

Greenwood & Batley, Ltd., held their annual meeting on Tuesday last, when Col. H. A. Micklem (chairman), who presided, after referring to the death of Mr. S. Batley, reviewed the accounts and said that in the past year new plant and machines had been installed to the value of £24,681. They had obtained their share of the further expansion of trade experienced during 1936 and practically all departments had been well employed. Their sales showed an improvement of 12½ per cent., as compared with the preceding year, while their order book stood at a higher figure than for many years past and had nearly doubled in amount during the past twelve months. Export figures had been maintained and they had some important foreign orders on hand. Their National Defence Contribution would probably amount to about £1,500.

Vactric, Ltd.—The directors announce that satisfactory progress has been made in the settlement of the fire claim. They have therefore declared an interim dividend of 5 per cent. on the 400,000 original ordinary shares of 5s. and an interim at the same rate per annum, equivalent to 2.363 per cent. on the full nominal value, on the 200,000 ordinary shares issued in January last. It was announced on May 25th that the directors had temporarily postponed the declaration of an interim dividend until the effect of the fire at the Cricklewood factory and the incidence of the National Defence Contribution could be more clearly ascertained. The dividend now declared is about equivalent in amount to the 6¼ per cent. interim paid last year.

The General Gas & Electricity Co., Ltd.—Presenting the report at the annual general meeting on June 30th Mr. W. A. Scott, chairman, declared that the result of the year's working had been one of steady expansion and the benefit of the expenditure on extensions to the works of the company and its subsidiaries had to some extent been realised. The directors were able to recommend a dividend of 5 per cent. (same). Profits from subsidiaries and the company's works showed an increase from £12,606 to £14,394, while the profits of the company as a whole had risen from £10,512 to £13,116. The business had made steady progress and the prospects for the future were still better.

Ward & Goldstone, Ltd.—Speaking at the annual general meeting held on June 30th Mr. M. H. Goldstone, chairman, said it was expected that the entire transfer of plant to the company's new building extensions would be effected within the next few weeks. The directors anticipated that with the modern works layout and the new machinery in operation the heavy outlay would prove well justified. In spite of the dislocation due to the transfer to the new buildings business generally had developed satisfactorily and the manufacturing output had expanded.

Peter Brotherhood, Ltd.—The list of applications was opened on Tuesday last of an offer for sale of 165,000 5½ per cent. cumulative preference shares of £1 each at 20s. per share and 220,316 ordinary shares of 10s. each at 25s. per share. The company was incorporated as a private company in 1907 to take over as a going concern the business previously carried on under the style of Peter Brotherhood, and it was converted into a public company on June 29th last. The company's business includes the manufacture of a wide range of machinery and power plants, such as high and low-pressure compressors for air and gases, high speed forced lubrication steam engines, steam turbines, turbo-generators, Diesel engines, water-cooling towers, filtering plants, fans and dynamometers. The list was closed on the same morning, having been oversubscribed.

Newman & Watson, Ltd.—The first ordinary general meeting was held on June 30th. Mr. J. Newman, chairman, stated that the year under review had been most difficult. The troubled conditions on the Continent and the Government's rearmament programme had resulted in a considerable increase in the cost of all materials. However, providing conditions remained normal, he was looking forward with great confidence to the trading results of the current year. During March, April and May contracts had been secured amounting to over £140,000, all of which had been obtained on the basis of the new prices.

Hall Telephone Accessories, Ltd.—A resolution authorising the increase of the capital to £500,000 by the creation of 500,000 10s. shares was carried unanimously at an extraordinary meeting held on June 30th. The new shares are to be offered at a premium of 1s. a share to all shareholders on the register on June 30th in the proportion of one share for every three held.

Thomas De La Rue & Co. report a net profit for the year ended March 27th of £51,122, as compared with £31,141 in the preceding year, to which is added £8,755 brought in. It is proposed to pay a dividend of 8 per cent. on enlarged capital (against 6 per cent.) and to place £31,699 to general reserve. A balance of £3,378 is available for redemption of the profit-sharing certificates, and the company will invite tenders from certificate holders.

The Bagdad Light & Power Co. reports a balance of revenue for 1936 of £58,583, as compared with £49,637 in the preceding year, to which is added interest, &c., £268, and £7,141 brought in. From this is deducted depreciation £18,836, income-tax and Iraq Government's participation in profits £18,957, writing off cost of investment £299, and preference dividend £17,497. The ordinary dividend for the year is 2 per cent., tax free (against 2½ per cent.), and £6,402 is carried forward.

The Great Northern Telegraph Co.'s Holding Co. proposes to distribute a total dividend of 23½ per cent. (same as last year) and to set aside kr. 615,000 for taxes and to carry forward kr. 5,204.

Chadburn's (Ship) Telegraph Co. reports a net profit of £6,850, to which is added £764 brought in. The dividend for the year is 6 per cent. (against 4 per cent.), plus a bonus of 4 per cent., and £3,114 is carried forward.

W. T. Avery & Co. have announced a final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the year (same).

Compania Hispaño-Americana de Electricidad, S.A. (Chade) is to pay a supplementary dividend of 30 gold pesetas on its "A," "B" and "C" shares and 6 gold pesetas on its "D" and "E" shares. For the purposes of this payment the equivalent to a gold peseta is fixed at 1.43 Swiss francs, the dividends being therefore Sw. fr. 42.90 and Sw. fr. 8.58 respectively.

The Hankow Light & Power Co., Ltd., is to pay dividends at the rate of 3⅜ per cent. on its first preference shares and 4 per cent. on its second preference shares for the half-year ended June 30th.

The Ultra Electric (Holdings), Ltd., announces a final dividend of 7½ per cent. on its ordinary shares, making 12½ per cent. for the year. For the first period from May 29th, 1935, to July 16th, 1936, a dividend of 6 per cent. was paid.

The Jerusalem Electric & Public Service Corporation, Ltd., proposes to pay a first and final dividend of 6 per cent. (against 5 per cent.) on its ordinary shares.

Montreal Light, Heat & Power Consolidated announces a quarterly dividend of 38 cents (same) on its common shares.

Stocks and Shares

TUESDAY EVENING.

IT can be truthfully said that the condition of Stock Exchange business shows a slight improvement upon that of the past few weeks. Apparently impressed by such favourable factors as, for instance, improved trade returns, better employment figures, and many satisfactory dividend announcements, the investor is paying rather more heed to Stock Exchange markets, though speculation remains almost dormant. The political situation in Europe at the present time continues to be one of the principal considerations making for caution on the part of the capitalist. Another which weighs with him is the consistent manner in which prices, until the last few business days, have dwindled in value; there is nothing like a falling market to induce uneasiness, just as a rising market tempts people to buy, rather than to take advantage of improvement in prices.

The holiday season of the year is at hand and this has to be taken into account as one reason for the lack of animation. New issues are held back by the prevailing quietude. The pigeon-holes of promoters and issuing-houses are full of propositions which are only waiting for a propitious moment in order to put in their appearance. The newcomers which appeal to the public for capital are meeting with a somewhat mixed reception.

Gilt-edged Stocks

Investors remain as chary about putting their money into safety-first stocks as they do about taking a hand in more speculative securities. The gilt-edged market is anything but accustomed to seeing the quotation for War Loan in two figures; before last week the price had not been below par since 1933. The present cold-shouldering of gilt-edged securities on the part of the public, the banks and other institutions is, of course, mainly a reflection of the wait-and-see attitude towards events in Europe. At the same time a contributor to depression has been the chilly reception accorded to such new gilt-edged issues as the market has recently been asked to absorb. The latter process is achieved only at the expense of a certain amount of financial indigestion.

Electricity Supply Share Prices

After being shaken rather sharply by the unpopular Government reorganisation proposals, confidence in the security and general merits of electricity supply shares is slow to become re-established. What improvement there is has confined itself, so far, largely to sentiment; no noticeable effect has yet materialised in share prices. The apprehension aroused by the Government's manner of interpreting the McGowan recommendations is reflected to some extent in a comparison of to-day's prices with those ruling, say, seven weeks ago,

although the intervening period has been, of course, an unhappy one for most industrial ordinary shares. County of London Electric stood then at 51s. 6d., against 46s. 6d. now; Metropolitans, at 45s., have fallen by 3s. in the time, and Midland Counties, at 36s., by 4s. North Easterns, now 31s. 6d., are 2s. 6d. down, Lancashires, at 33s. 6d., have lost 1s. 6d., and Yorkshires, at 39s., are 4s. lower, as are Scottish Powers at 36s. Of the holding companies, Edmundsons stand at 40s., as compared with 42s. previously, Electrical Finance and Securities at 53s. 9d. against 57s. 6d., and British Light and Power at 26s. 6d. against 28s. 9d. Shares in the group have depreciated to a level where the average yield is approaching 4½ per cent. on the money, a return which may be thought attractive in ordinary shares of gilt-edged type.

Yields on Supply Shares

For those who feel that the present time is propitious for taking an interest in electricity supply ordinary shares, some people think that the North Eastern Electric Supply has a wide scope for expansion, and the shares at 31s. 9d. pay £4 8s. per cent. The dividend was put up in respect of last year to 7 per cent., as against 6 per cent. in previous years. London Associated Electricity ordinary shares at 31s. 6d. return £4 8s. 6d. per cent., and can be expected to receive the 7 per cent. dividend which has come to be regarded as the standard rate. City Lights yield 4½ per cent. on the money, and in this selection the investor can hardly go wrong if he is content to take a 4½ per cent. return from first rate industrial ordinary shares.

Prices of shares in home undertakings have moved scarcely at all during the past week, but a few quotations in the overseas group went better. Jerusalem Electrics at 26s., ex dividend, have fully recovered deduction of the 7 per cent. payment; the distribution has been raised regularly by 1 per cent. in each year since 1933. Palestine "A" shares remain on the dull side at 37s. 3d., ex dividend. The premium on Calcutta Electric new ordinary has hardened to 21s. 3d. The old shares are 41s. 3d., ex-rights. Perak River Hydros moved up a few pence to 27s. on news that the 4 per cent. debentures are to be redeemed.

G.E.C. Meeting

Holders of all kinds of electrical equipment shares follow with natural interest the report of proceedings at the General Electric Company's annual meetings. In whatever branch of the industry the investor has chosen for his money, he is fairly certain to gain, from the G.E.C. chairman, useful information on current conditions and a pointer to the course of future events. The market read with satisfaction the chairman's speech as to the present position of electrical equipment undertakings, tempered with no more than the usual note of caution in regard to the influence of rising costs on future profits. The impression was not sufficiently strong to arouse such interest as might influence share prices to any extent. As regards General Electric ordinary, the price is a few pence down at 78s. 6d., although there is a growing tendency mentally to couple the company's impressive reserves with the idea of a scrip bonus at some future time. Cable manufacturing shares, notably British Insulated at 4¾ and Enfields at 5$\frac{1}{16}$, show something of a recovery. Switchgear and Cowans are a shade harder at 17s. 6d. A decline of ⅛ in Chloride Electrical Storage "A" left the price at £4.

Cable and Wireless

After what might pass, in these quiet days, for a burst of interest in Cable and Wireless ordinary stocks, interest has again subsided, without, however, involving anything drastic in the way of price falls. The "A" stock, it is true, reacted 10s. to 24¾, but still retains a point of the recent advance. The "B" ordinary stands firm at 6¼. The preference changes hands occasionally at around 111½. Globe Telegraph issues have shown no disposition to respond to the hope expressed at the annual meeting that this year's increase in the ordinary distribution from 4½ to 5¼ per cent. might be taken "as a harbinger of better dividends in future." Other communication stocks benefited by an upswing in transatlantic prices. American Telephones spurted from 162¾ to 167¼, and Western Unions at 46½ recovered partially from the depressing effect of last month's decision by the Federal Communications Committee in connection with cable rates.

Miscellaneous Matters

The Victoria Falls Power Company's report, while showing a further expansion in profits, fell short of what the market expected. The price of the ordinary shares was marked down, as a result, by ⅛ to 3$\frac{1}{16}$. London Transport "C" stock, in falling to 78, showed a loss of a further 2 points. Tillings have dropped 1s. to 59s. 6d. Bristol Trams also are 1s. lower at 41s. British Electric Traction stocks are unchanged. Brazilian Tractions recovered 5s. 8d. in sympathy with a general rise in the American market induced by the impression that the strike fever in the United States gives signs of abatement. Baird Television shares are dull; the preferred at 1s., the deferred at 2s. 3d. The rubber market remains listless and neglected.

Holders of Metropolitan Electric Supply new shares may be reminded that the final call of 17s. 6d. per share falls due on Monday, July 12th. This will make the shares 37s. 6d. paid; the present price of 8s. premium is a shade above that of the senior ordinary shares.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Dividend. Nom.	Previous.	Last.	Price. July 6	Rise or Fall.	Yield. p.c. £ s. d.
Bournemouth and Poole	1	15	15	67/6	—	4 9 0
City of London	1	7½	7½	33/–	—	4 11 0
Clyde Valley	1	7	8	39/–	—	4 2 1
County of London	1	10½	10½	46/6	—	4 10 6
Edmundson's 7% Pref.	1	7	7	33/6	–6d.	4 3 7
Do. Ord.	1	8	9	40/–	—	4 10 0
Elec. Dis. Yorkshire	1	9	9	41/6	–1/–	4 6 10
Elec. Fin. and Securities	1	12½	12½	2 15/16	—	4 13 0
Elec. Supply Corporation	1	11	12	51/3	—	4 13 8
Lancs Light and Power	1	7½	7½	33/6	—	4 9 7
Lond. Assoc. Electric	1	—	7	31/3	—	4 9 6
London Electric	1	7	8	35/6	—	4 10 2
London Power Deb. Red.	Stock	5	5	106½	—	4 14 0
Metropolitan	1	10	10	45/–	—	4 9 0
Midland Counties	1	7½	8	36/–	—	4 9 0
Mid. Elec. Power	1	8	9	2	—	4 10 0
North Eastern Electric Ordinary	1	6	7	31/6	—	4 9 0
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	45/–	—	4 9 0
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	47/6	+ 1/6	4 4 2
Do. do. 6% Pref.	1	6	6	30.6	–6d.	3 18 8
Scottish Power	1	8	8	36/–	—	4 9 0
South London	1	7	7	32/–	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/–	—	6 16 4
Yorkshire Elec.	1	8	8	39/–	—	4 2 1

PUBLIC BOARDS.

Central Electricity, 1950–70	Stock	5	5	114	—	4 7 9
Do. 1955–75	,,	5	5	115½	—	4 6 7
Do. 1951–73	,,	4½	4½	109	—	4 2 7
Do. 1963–93	,,	—	3½	97½	—	3 11 10
London Elec. Trans. Gtd.	,,	—	2½	88xd.	—	2 16 10
London & Home Counties, 1955–75	,,	4½	4½	109xd.	—	4 2 7
London Passenger Transport, A	,,	—	4½	116½	—	3 17 3
Do. do. B	,,	—	5	117½	—	4 5 1
Do. do. C	,,	4	4	78	–2	5 2 7
West Midlands Joint Elec. 1948–68	,,	—	5	111½	—	4 9 8

TELEGRAPH AND TELEPHONE.

American Tel. & Tel.	$160	9	9	167½	+5	5 7 6
Anglo-Am. Tel. Pref.	Stock	6	6	125	–1	4 16 0
Do. Def.	,,	1½	1½	29½	—	5 1 8
Cable & Wireless 5½% Pref.	,,	4½	5½	111½	—	4 18 3
Do. A. 7½% Ord.	,,	Nil	Nil	24½	–½	—
Do. B. Ord.	,,	Nil	Nil	6½	—	—
Globe Tel. & Tel. Ord.	10	4½*	5½*	15½	—	3 9 10
Do. do. Pref.	10	6	6	14	—	4 5 9
Great Northern Tel.	10	20	20	41½	–1	4 16 5
Marconi-Marine	1	10	7½	1½	—	4 5 9
Oriental Telephone Ord.	1	12*	12*	3½	—	3 16 10

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	21½	—	—
British Electric Traction Def. Ord.	,,	5	5	1275	—	—
Do. do. Pref. Ord.	,,	8	8	165	—	4 15 5
Brazil Traction	$100	40 cts.	50 cts.	24⅜	+⅛	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	105½	—	4 14 9
Mexican Light Common	$100	Nil	Nil	2	—	—
Do. 1st Bonds	$500	5	5	44½	—	—
Victoria Falls Ord.	1	20	12	61/3	–⅛	3 18 5
West Riding	1	6½	10	45/–	—	4 9 0

MANUFACTURING COMPANIES.

Aron Electricity Ord.	1	15	15	2½	—	6 0 0
Assoc. Elec. Ord.	1	8	10	47/–	—	4 5 2
Do. Pref.	1	8	8	37/6	—	4 5 3
Babcock & Wilcox	1	8	10	48/9	—	4 2 0
British Aluminium Ord.	1	7½	10	50/–	—	4 0 0
British Insulated Ord.	Stock	20	20	4¾	+⅛	4 4 2
Brush Ord.	Stock	Nil	Nil	49½	—	—
Callender's	1	15	15	4 7/16	+ 1/16	3 5 9
Do. 6½% Pref.	1	6½	6½	30/-	—	4 6 8
Crompton Parkinson Ord.	5/–	12½	12½	57/6	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	37/6	—	5 6 8
Enfield Cable Ord.	1	25	25	5 11/16	+ 1/16	4 8 0
English Electric	1	Nil	Nil	33/–	+6d.	—
Do. do. Pref.	1	6½	6½	26/–	—	5 8 4
Ericsson Tel.	5/–	20*	25	2⅜	—	2 12 8
Ever Ready	5/–	35	45	33/–	—	6 16 6
Ferranti Pref.	1	7	7	27/6	+ 1/6	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	78/6	–6d.	4 9 3
Henley's	5/–	30	15	19/3	–3d.	3 17 10
Do. 4½% Pref.	1	4½	4½	1½	—	4 0 0
India-Rubber Pref.	1	5½	5½	22/6	—	4 17 9
Johnson & Phillips	1	7½	10	41/3	–9d.	4 16 10
Lancashire Dynamo	1	10	20	3 1/16	—	6 1 0
Siemens Ord.	1	6	7½	32/6	—	4 12 4
Telegraph Construction	£1	Nil	7½	2 1/16	—	3 8 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1935

25286. "Manufacture of welding electrodes and electric make-and-break switch contacts." Naamlooze Venncotschap Molybdenum Co. September 12th, 1934. (Addition to 456018.) (467162.)
27592. "Electric distant-control systems." N. Japolsky. October 5th, 1935. (466881.)
27991. "Carrier frequency electric communication, signalling, indicating, and remote-control systems." J. L. Hills. October 10th, 1935. (Cognate application 23338/36.) (467163.)
33085. "Motor-protective and other automatic switches or circuit-breakers." G. E. Crabtree, W. T. Elliott, E. Badham and R. W. Thornton (legal representatives of J. A. Crabtree, dec.). November 29th, 1935. (467203.)
33461. "Pedal-operated control mechanisms for electric road vehicles." Sunbeam Commercial Vehicles, Ltd., and J. C. Dabbs. December 3rd, 1935. (467086.)
33891. "System for electrical transmission of wave-signals such as speech or television." C. J. Francis and L. F. Savage. December 6th, 1935. (467095.)
33929. "Coin-freed mechanism for vending electricity on a time basis." Stotz-Kontakt Ges. October 26th, 1935. (467170.)
33952. "Radio or like receivers." Ferranti, Ltd., and A. W. Edwards. December 7th, 1935. (467171.)
33973. "Telephone systems." Automatic Electric Co., Ltd., C. E. Beale and I. T. Richards. December 7th, 1935. (466889.)
34040. "Electric heaters." R. F. May. December 9th, 1935. (467231.)
34045. "Electrolytic condensers and other electrolytic devices." Dubilier Condenser Co. (1925), Ltd., and N. C. Moore. December 9th, 1935. (Cognate applications 7248/36 and 13622/36.) (467024.)
34064. "Electric-discharge devices." General Electric Co., Ltd., and N. L. Harris. December 9th, 1935. (467025.)
34091. "Electric control systems for direct-current drives." British Thomson-Houston Co., Ltd. December 7th, 1934. (466893.)
34094. "Electric motor control systems." British Thomson-Houston Co., Ltd., and G. Ovens. December 9th, 1935. (467029.)
34114. "Automatic switches for use in telephone or like systems." Automatic Electric Co., Ltd., and R. N Saxby (December 9th, 1935. (467031.)
34216. "Telegraphones." Marconi's Wireless Telegraph Co., Ltd . F. M. G. Murphy and C. J. F. Tweed. December 10th, 1935. (467105.)
34218. "Thermionic valves." Marconi's Wireless Telegraph Co., Ltd., and G. F. Brett. December 10th, 1935. (467106.)
34283. "Conduit fittings for housing and protecting electrical conductors, such as those connecting electric supply service fuse-boxes to meters." V. Hope. December 11th, 1935. (467177.)
34289. "Automatic telephone exchange switching systems." W. Aitken. December 11th, 1935. (467178.)
34342. "Electric cables." Callender's Cable & Construction Co., Ltd., L. G. Brazier, G. M. Hamilton and R. S. Vincent. December 11th, 1935. (Cognate applications 34343/35, 15247/36 and 30848/36.) (467179.)
34370. "Manufacture of filaments for electric incandescent lamps." General Electric Co., Ltd., and R. E. Leeds. December 11th, 1935. (467187.)
34372. "Television or like systems." Baird Television, Ltd., and T. M. C. Lance. December 11th, 1935. (467188.)
34412. "Electric potential sensitive devices." Steatite & Porcelain Products, Ltd., and J. A. Sudgen. December 11th, 1935. (Cognate application 920/36.) (467190.)
34458. "Television or the like receivers employing cathode-ray tubes." Baird Television, Ltd., and J. L. Baird. December 12th, 1935. (467195.)
34479. "Portable electric appliances for medical purposes." Scholl Manufacturing Co., Ltd., and G. Thornton-Norris. December 12th, 1935. (467197.)
34528. "Electro-magnetically operated reciprocating devices." E. P. Sanderson and Amal, Ltd. December 12th, 1935. (Cognate application 30585/36.) (467199.)
34623. "Remotely controlled printing-telegraph recording mechanisms." A. H. Stevens (International Business Machines Corporation). December 13th, 1935. (466897.)
34676 "Electric signalling apparatus for use in conjunction with an automatic telephone system." E. Shipton. December 13th, 1935. (467204.)
34698. "Electric irons and electric switches therefor." A. H. F. Perl. December 13th, 1935. (467206.)
34734/5. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., B. H. Leeson and R. W. Wild. December 14th, 1935. (467210/1.)
34937. "Production of electrical insulating materials." Steatit-Magnesia Akt.-Ges. December 14th, 1934. (467243.)
35016. "Electric motor control systems." British Thomson-Houston Co., Ltd., and L. J. Clark. December 17th, 1935. (467116.)

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720. "Fluxes and flux-coated electrodes for electric welding." T. C. R. Shepherd and Metropolitan-Vickers Electrical Co., Ltd. January 8th, 1936. (466902.)
721. "Fluxes and flux-coated electrodes for electric welding." M. R. Moritz, I. C. Fitch and Metropolitan-Vickers Electrical Co., Ltd. January 8th, 1936. (466903.)
2992. "Television transmitting apparatus." General Electric Co., Ltd., and D. C. Espley. January 31st, 1936. (Cognate application 28410/36.) (466966.)
3226. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. February 1st, 1935. (466967.)
6716. "Holders for tubular electric lamps." A. J. Clayton. March 5th, 1936. (466974.)
9177. "Selenium rectifiers." Suddeutsche Apparate Fabrik Ges. April 11th, 1935. (466917.)
15231. "Automatic or semi-automatic telephone-exchange systems." Standard Telephones & Cables, Ltd. May 29th, 1936. (466986.)
16019. "Photo-cell circuit arrangements." Marconi's Wireless Telegraph Co., Ltd. June 6th, 1935. (467049.)
16875. "Magnetic testing devices." British Thomson-Houston Co., Ltd. June 20th, 1935. (466925.)
20678. "Electric-discharge tube circuit arrangements and electric discharge tubes for use therein." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 4th, 1935. (466929.)
20885. "Generator of synchronising impulses for television and the like." Radioakt.-Ges. D. S. Loewe. July 29th, 1935. (466930.)
23639. "Electric adaptors." W. Dabscheck. August 28th, 1935. (466935.)
24325. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. Sept. 6th, 1935. (466936.)
25152. "Photo-electric cell suitable for use in the reproduction of or recording of sound records by the balanced cell system." Zeiss Ikon Akt.-Ges. January 29th, 1936. (467059.)
25874. "Electric circuit-breaker controlled by a combination lock device, suitable in particular for use as an anti-theft device for automobile vehicles." G. J. E. Triponney. September 23rd, 1936. (466937.)
25142. "Devices for making electrical contact when subjected to pressure." J. A. Horton. September 26th, 1936. (466938.)
26661. "Current core with a magnetic shunt for induction measuring apparatus." Landis & Gyr Akt.-Ges. October 12th, 1935. (467062.)
27079. "Electrically heated melting-pots for type-casting machines and the like." P. A. Klinge. October 6th, 1936. (467002.)
27370. "Control devices for the lighting equipment of vehicles." Fiat Soc. Anon. October 10th, 1935. (466939.)
30650. "Electric-signalling cables." Felten & Guilleaume Carlswerk Akt.-Ges. November 27th, 1935. (466942.)
30681. "Lamp sockets." General Electric Co., Ltd. December 18th, 1935. (466943.)
30725. "Dollies for electric cells and a method of and a machine for the manufacture thereof." Economic Distributors, Ltd. (Autom Spezial-Maschinen Ges.) November 10th, 1936. (467148.)
30842. "Electric signalling systems for railways." Svenska Aktiebolaget Gas-Accumulator. November 11th, 1935. (466944.)
30865. "Means of control for regenerative electric motors." Guy Motors, Ltd., S. S. Guy and J. N. Court. November 12th, 1936. (Addition to 413038.) (466945.)
31035. "Television." W. C. Bailey and E. S. Ashdown. November 13th, 1936. (467227.)
31104. "Electrolytic production of alkaline lyes and sulphuric acid." I. G. Farbenindustrie Akt.-Ges. February 20th, 1936. (466946.)
31312. "Mercury and like conducting-liquid electric switches." British Thomson-Houston Co., Ltd. November 15th, 1935. (467068.)
31345. "Directive antennae structures." C. Lorenz Akt.-Ges. November 18th, 1935. (466948.)
31735. "Electroplating of aluminium or aluminium alloys." Schering-Kahlbaum Akt.-Ges. November 19th, 1935. (Cognate application 31736/36.) (466949.)
32389. "Electro-magnetic clutches." Igranic Electric Co., Ltd. November 29th, 1935. (466950.)
33444. "Electrical connecting members with soldering lugs." E. Kleinmann and A. Mendel. April 1st, 1936. (Addition to 459613.) (467011.)
35637. "Systems for supplying photo-electric cells." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. December 31st, 1935. (467073.)

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209. "Antenna systems." British Thomson-Houston Co., Ltd. January 3rd, 1936. (467012.)
654. "Electrical brush contacts." E. Kleinmann and A. Mendel. October 3rd, 1936. (467014.)
1211. "Devices for transmitting electric currents between rotatable and stationary connection parts." C. Zeiss (a firm). February 5th, 1936. (467018.)
3025. "Electric terminals." Chloride Electrical Storage Co., Ltd. March 10th, 1936. (467076.)
8733. "Electric-discharge tubes formed of quartz." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 27th, 1936. (467078.)
11731. "Electric distant-control systems." N. Japolsky. October 5th, 1935. (Divided out of 466831.) (466952.)
12981. "Telephone systems." Automatic Electric Co., Ltd. November 7th, 1934. (Divided out of 463874.) (466953.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 30th :—

Permelitz. No. 576657. Class 6. Enamelled wire.—British Permel Enamelled Wire Co., Ltd., Columbia House, Aldwych, W.C.2.

Alpinator. No. 577539. Class 6. Air-conditioning machines.—W. S. Darby, 21b, Carlton Road, Putney, S.W.15.

G.W.Z. (lettering and design). No. 567785. Class 8. Electric dry cells and batteries (not for medical purposes).—British G.W.Z. Battery Co., Ltd., 5, Falmouth Road, Trading Estate, Slough, Bucks.

Nonflammite. No. 577091. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Durham Cables, Ltd., Birtley, County Durham.

Belcon. No. 575285. Class 8. Electrical condensers, resistances and primary cells (electrical).—British Electrolytic Condenser Co., Ltd., 52, Vicarage Lane, Ilford, Essex.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—School, Middlefield (£45,000); city architect.

Aberystwyth.—Hospital, with electrical work; Collins & Godfrey, builders, The Cross, Tewkesbury.

Amesbury.—Houses, Amesbury and Winterbourne; R.D.C. surveyor.

Bakewell.—Houses (20), Padley, Grindleford; G. Bradbury.

Barnsley.—Houses (150), California Gardens; H. Taylor, borough surveyor.

Bebington.—Cinema, Bolton Road East (£40,000), for the Regent Enterprises, Ltd.; Graylands Ltd., builders, Liverpool.

Beckenham.—Extensions to baths (£39,475); borough engineer.

Bentley (YORKSHIRE).—Houses (174), Scotthorpe; R. N. Penlington, U.D.C. surveyor, Cook Street.

Billericay.—Houses (20) and bungalows for aged persons; U.D.C. surveyor.

Birmingham.—Schools (£140,400) for E.C. Rebuilding, Highbury Home for Aged Women (£50,000), with electrical work; H. J. Manzoni, city architect, Council House.

Blackburn.—Houses (124), Higher Hill Farm site, Longshaw (£50,648); borough surveyor.

Bradford.—Houses (92), Gibson Street (£32,300); L. & W. Morrell. Cinema and shops, Broadway and Leeds Road; Associated Cinema Properties, Ltd.

Bromborough.—Cinema for P. M. Hanmer, manager of Regent Enterprises Co., Ltd. (£40,000); F. Evans, architect, North John Street, Liverpool.

Burnley.—Extensions to Infectious Diseases Hospital, for the Joint Hospital Board.

Carlisle.—R.A.F. depot for the Air Ministry (£800,000); J. Laing and Sons, builders, Dalston Street.

Carlton.—Houses (63), Station Road and Congingswath Road (£25,562); H. Loach & Son, builders, Carlton, Nottinghamshire.

Castle Douglas.—Houses (66), Laurel Bank site (electrical work); M. Purdon Smith, architect, 95, Irish Street, Dumfries.

Caterham.—Houses (34), Ninehams Road; G. H. Fowler.

Chelmsford.—Houses (36), Widford estate; borough engineer.

Chester.—School, Newton (£13,189); J. Mayers, Sons & Co., Ltd.

Croydon.—Factory, Addiscombe, for Creed and Co., Ltd., East Croydon.

Darlington.—Town Hall (£90,000); Briggs and Thornley, architects, Royal Liverpool Buildings, Liverpool.

Docking.—Houses (38), six sites (£11,898); W. Tickner, builders, Sprowston, Norwich.

Doncaster.—Isolation hospital, Crookhill Road, Conisborough, for the Doncaster and Mexborough Joint Hospital Board; Walker and Thompson, architects, Carbon Chambers, Doncaster.

Dundee.—Extensions to D. MacLean & Sons' premises, Fairmuir Road.

Dunfermline.—Houses (72), Kingscathill (£33,222); D. H. Shaw, burgh surveyor, City Chambers, Dunfermline.

Edinburgh.—Cinema, Newbattle Terrace, Morningside; T. Bowhill Gibson, architect.

Essex.—Schools, Dagenham and Great Wakering; county architect, Chelmsford.

Farnham.—Houses (62), Institute Field, Wrecclesham; R. M. Sargent, building surveyor.

Greenock.—Cinema, for the Associated British Cinemas, Ltd.

Gwyrfai (CAERNARVONSHIRE).—Houses (297), on various sites; D. H. Roberts, R.D.C. surveyor, 22, Castle Square, Caernarvon.

Halifax.—Cinema, Crossfields, for the Odeon Theatres, Ltd.; M. J. Gleeson, Ltd., builders, Chesterfield Road, Sheffield.

Hamilton.—Houses (806), school and public buildings, Whitehill estate; J. Lockhead, Municipal Buildings, Hamilton.

Haywards Heath.—Cinema, South Road, for the Union Cinema Co., Ltd., 15, Regent Street, London, S.W.1.

Ipswich.—Cinema, Landseer Road and Nacton Road; C. E. Wilford, architect, Market Street, Leicester.

Irish Free State (DUBLIN).—Houses (453), Crumlin North; N. A. Chance, borough surveyor, Exchange Buildings. (KILDARE).—District hospital, Athy (£17,261). for the Board of Health; Messrs. Fogarty, builders, Templemore. (NEWBRIDGE, Co. KILDARE).—Houses (26), Newbridge, for the Kildare Board of Health. County Hospital, Naas; Nicholas O'Dwyer, engineer, Veritas House, Lower Abbey Street, Dublin. (SLIGO).—Houses (132), Knappaghbeg (£67,314); Molloy & Sons, builders, Balina.

Isle of Wight.—Houses (22), Freshwater and Newchurch; E. L. Smith, architect, High Street, Newport, Isle of Wight.

Jarrow-on-Tyne.—Dog racing stadium with totalisator, clubhouse, &c. (£20,000), Campbell Park, for the South Tyne Racing Stadium, Ltd.

Keighley.—Houses (25), Carforth Road; J. Rishworth. Houses (40), Westburn Avenue; D. Fortune.

Kent.—Alterations and additions to maternity and infirmary blocks, County Hospital, Sheppey, for C.C.; W. H. Robinson, county architect. Maidstone.

Kilmarnock.—Houses, near New Street and Hurlford Road, Riccarton (£35,000); burgh surveyor.

Lancashire.—Hospital, Ulverston (£75,000), for C.C.; county architect, Preston. School, Farington, near Preston, for County E.C.; J. C. Prestwich & Sons, architects. Bradshaw Gate, Leigh. School, Turton (Bolton) for County E.C.: Bradshaw, Gass and Hope, architects, 19, Silverwell Street, Bolton.

Leeds.—Office buildings, for the River Ouse Catchment Board; V. Bain, architect, 38, Albion Street.

Leicester.—Extensions to Royal Infirmary (£60,000); Pick, Everard, Keay and Gimson, architects, 6, Millstone Lane. Rebuilding premises, destroyed by fire, Church Gate (£16,000), for the Co-operative Society.

London.—(DEPTFORD).—Houses and flats, Ashby Road and Wickham Road; Dennant & Laver, 239a, Lewisham High Road, S.E.4. (GREENWICH).—Town Hall and municipal buildings, at the corner of Royal Hill and London Street (£220,995); W. Moss & Sons, Ltd., builders, North Circular Road, N.W.2. (LAMBETH).—Extensions to County Hall (£436,033); Higgs & Hill, Ltd., Crown Works, South Lambeth Road, S.W.9. (ST. MARYLEBONE).—Shops and offices, Baker Street; J. Stanley Beard & Bennett, 101, Baker Street, W.1. (ST. PANCRAS).—Flats (94), Camden Park Road (£80,345); A. J. Thomas, architect, 51a, Sloane Street, S.W.1. (SOUTHWARK).—Tenements, Lant Street (£11,597); John Knox (Bristol), Ltd., L.C.C. housing estate, Porters Avenue, Dagenham. (S.W.1).—Office buildings, &c., Buckingham Palace Road, for Imperial Airways, Ltd.; E. A. Roome & Co., Ltd., builders, 7, Urwick Road, E.9.

Luton.—Maternity and child welfare clinic at the corner of Dunstable Road and Beechwood Road; J. W. Tomlinson, borough surveyor, Town Hall.

Lye (WORCESTERSHIRE).—Shops, New Road, for Hipkiss & Walton, Hagley Road, Stourbridge; A. A. Griffiths, builders, Wordsley.

Manchester.—Houses (51), Bank House estate, Blackley; city architect. Additions to the Grange Street Municipal schools, Bradford; surveyor's department, Education Offices, Deansgate.

Mansfield.—Business premises, Regent Street and Westgate, for Marks & Spencer, Ltd.; Bovis, Ltd., builders, South Audley Street, London, W.1.

Montrose.—Town Hall, Marine Avenue; P. Maxwell, burgh surveyor, Town Buildings, Montrose.

Newark.—Houses (34), Bancroft Road; Beeston Development Co., Ltd.

Newbury.—Business premises, for Prices Tailors, Ltd.; Blaw & Peters, Ltd., builders, St. Albans.

Nottingham.—Factory, Prospect Street, for John Player & Sons; William Cowlin & Son, Ltd., builders, Stratton Street, Bristol.

Oxford.—Police headquarters (£47,124), and public bath, &c., Temple Road, Cowley; A. Carstairs, city engineer, Town Hall.

Plymouth.—Houses, Clynton; J. Rendel. Houses (52), Revel estate, Compton Park Road; M. Solomon. Cinema, dance hall, &c., Wolseley Road; Sound Movement Cinemas, Ltd.

Poole.—School, Wimborne Road; E. J. Goodacre, borough engineer, Poole.

Rawmarsh.—Houses (25); G. W. Meanley & Sons, Ltd., builders, Doncaster.

Renfrew.—Degreasing factory, Burnbank Chemical works, Paisley; W. Forres & Son (Paisley), Ltd. Extensions to works for Reid Gear Co., Napier Street, Linwood.

Rowley Regis.—Houses, Codsall and Wagon Street; M. A. Boswell, Wolverhampton. Houses (312), Throne Road; Eadie & Co., Wolverhampton.

Ruislip.—Cinema, Field End Road, Eastcote; H. D. Circuits, Ltd., 80, Regent Street, London, W.1.

St. Neots.—Houses, Huntingdon Road and Potton Road (£24,566); A. W. Shelton, builder, Peterborough.

Scarborough.—Offices, York Place, for the Scarborough Building Society; G. H. Fawsett, architect, York Place.

Sheffield.—Civic centre and flats (300) in blocks of four storeys, Edward Street, for the Housing Committee; W. G. Davies, city architect.

Shepton Mallet.—Houses (24), Holcombe and Pilton; T. P. Jordan, R.D.C. surveyor, Council Offices, Market Place.

Shrewsbury.—Houses (86), near Heathgates; A. W. Ward, borough surveyor, the Guildhall.

Sidcup.—Houses (91), Oakdene Avenue, Chislehurst; Ideal Property Trust, Sidcup. Houses (157), near Arterial Road, St. Paul's Cray; W. Norman & Son, Ltd.

Skegness.—Sewage works (£61,450); U.D.C. surveyor.

Smallburgh.—Houses, Happisburgh, Ludham, Trunch, Witton, and Hoveton; R.D.C. surveyor.

Somerset.—Girls' school, Bishop Fox's school, Taunton (£51.000), and extension to Street (Elmhurst) County school (£12,900), for County E.C.; county architect, Taunton.

South Shields.—Cinema, Pollard Street and Baring Street (£50,000); P. L. Browne & Sons, architects, Northumberland Street, Newcastle-on-Tyne.

Stratford-on-Avon.—Houses (76), on various sites; Knight & Carter, architects, 5, Rother Street.

Sutton Coldfield.—Houses (29), Plant Brook Road; County Estates (Derby), Ltd.

Tipton.—School, Locarno Road (£35,000), with electrical work; Dallow & Sons, builders, West Bromwich.

Truro.—Houses (74) and dwellings, Tregolls; city surveyor, Lemon Street.

Walsall.—Rebuilding Her Majesty's Theatre; Lang-Fox & Co., builders, Norton-on-Tees.

Walthamstow.—Extensions to William Morris Central schools, for E.C. (£25,479); G. H. Miller & Co., builders, Forest Gate, London, E.7.

West Hartlepool.—School, Brinkburn (£34,743), for E.C.

Wolverhampton.—Cinema, Penn Road; Salberg & Clift. School, Heath Town (£39,800), for E.C. Enlargement of senior school, Springfield Road (£26,975); R. Hallett & Sons.

Worcestershire.—School, Pedmore Road, Stourbridge (£34,524) for County E.C.; A. H. Guest, Ltd., Stourbridge.

Worthing.—Houses (371), Courtlands estate; S. C. Phillips, architect. Houses (39), and flats, Crowborough Drive; West Sussex Coast Development Co., Ltd. Houses (28), Field Place estate; Field Place Estate Co., Ltd. Ten shops, Goring Road; Healey & Mackenzie, architects.

York.—Houses, Yearsley Crescent; H. Williamson & Son. Houses, Cemetery Road, technical institute, Scarcroft Road and girls' school, Water Lane; city architect.